ESA DUE GlobSnow: An Overview

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GlobSnow: An Overview

❖ ESA DUE GlobSnow

- Global products on Snow Water Equivalent (SWE) and Snow Extent (SE) for climate research
  - Fundamental Climate Data Record (FCDR) aiming for ECV-record
- Team including Finnish, Austrian, Swiss, Norwegian and Canadian partners

ESA GlobSnow (2008 – 2011)

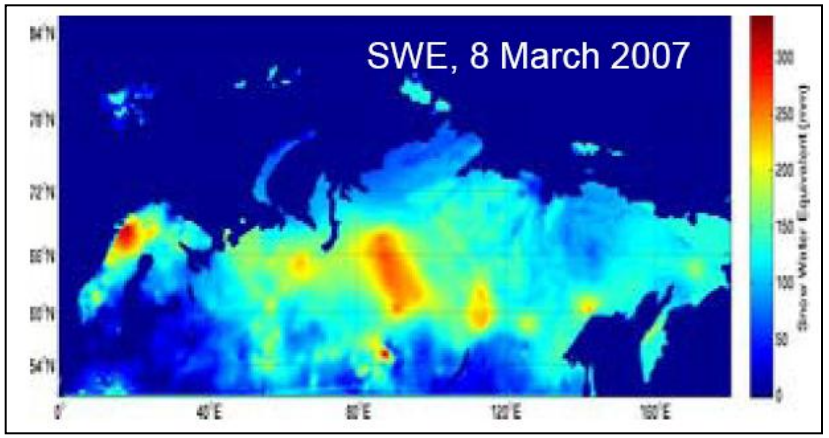
- Production of new global snow extent (SE) and snow water equivalent (SWE) climate data records, with a demonstration of a near-real-time processing capability.

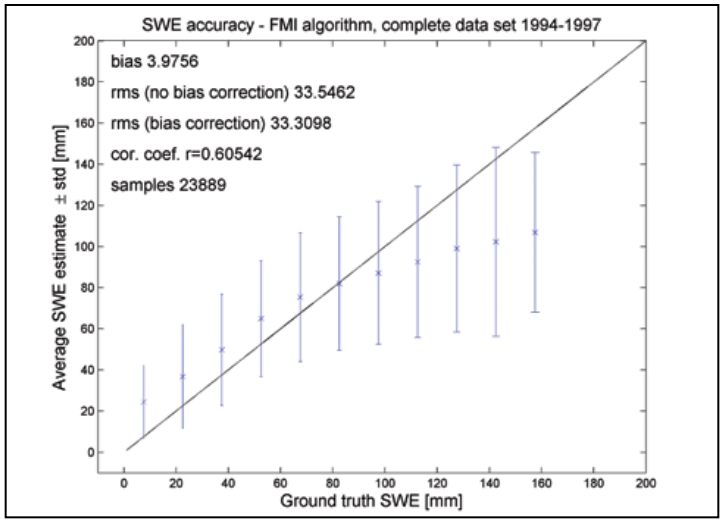
- Consortium led by the Finnish Meteorological Institute (FMI) with collaborators: ENVEO IT (Austria), GAMMA Remote Sensing (Switzerland), Norwegian Computing Center (NR), Finnish Environment Institute (SYKE), Environment Canada and Norut (Norway).

- Project details including technical reports and newsletters available at globsnow.fmi.fi.

GlobSnow SWE Product

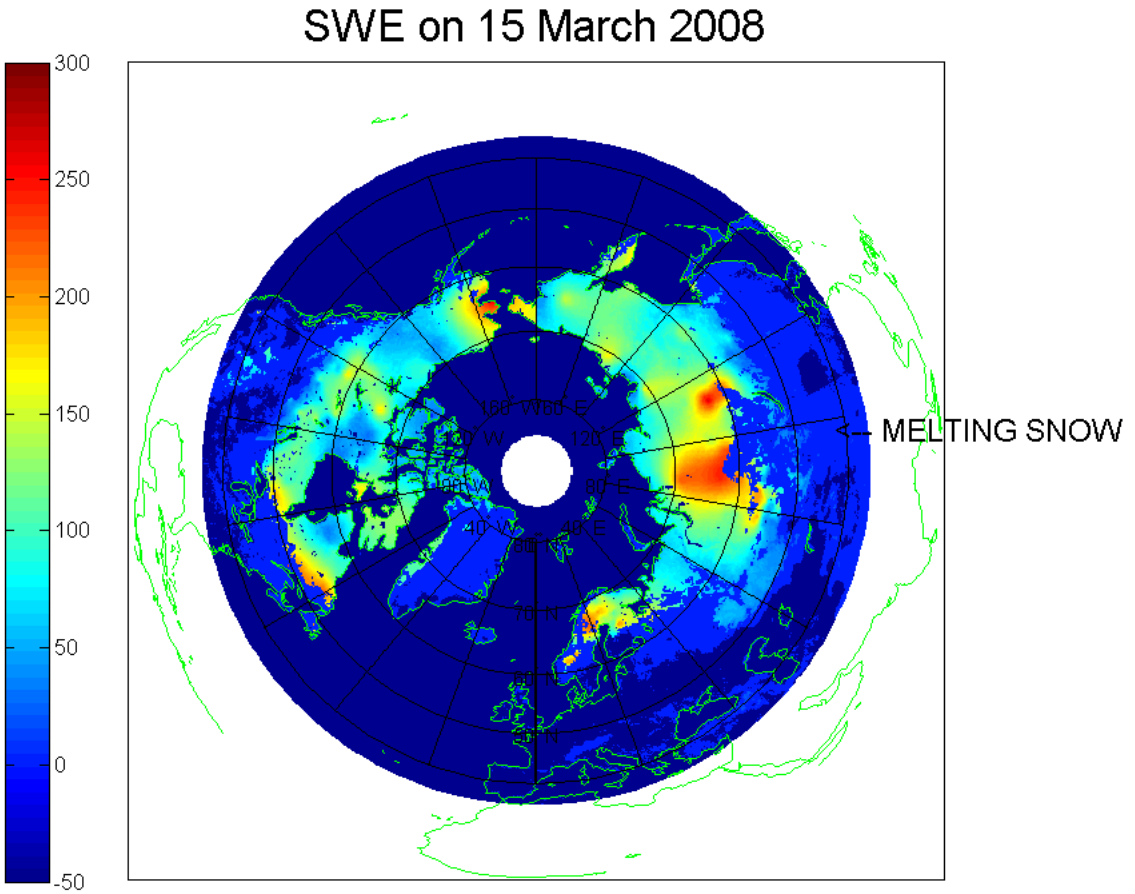
- Proposed approach: Assimilation of satellite data with *in situ* observations-derived bckground field on snow depth.
  - Only approach utilizing passive microwave radiometer observation providing sufficient accuracy level on a global scale
- Statistical error estimate produced for each grid cell.
- SWE retrievals for all terrestrial snow regions of northern hemisphere excluding alpine regions and glaciers.
- Time series extending from 1978 to present:
  - Full coverage for dry snow cover areas (combined mapping of melting regions)
  - Daily estimates calculated (aggregated to more practical end-products)
- Operational near-real-time service will be demonstrated during 2010/2011.





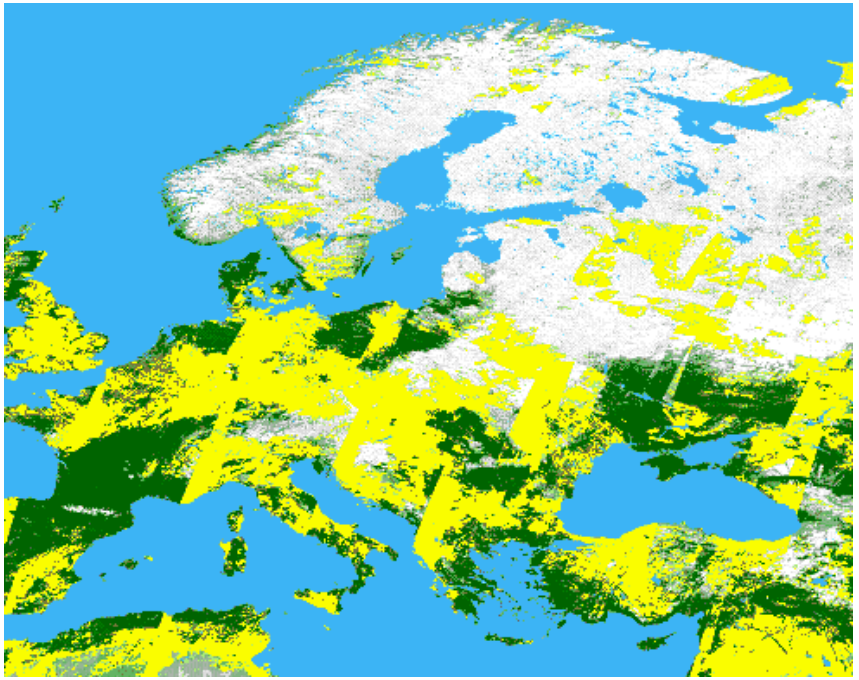
Planned Final SWE Product

- Possibly identifying different snow regions:
  - Dry snow area
    - Current dry snow detection limit propably too conservative (example on left)
  - Wet/melting snow region
  - Snow-free regions
- SWE can be also provided for the wet snow mapped region



GlobSnow SE Product

- Snow Extent based on optical ATSR (1995-) and AATSR (2002-)
- Two main techniques selected:
  - SCAmod algorithm for FSC by SYKE applicable to non-mountainous regions (including forested areas)
  - Norwegian Linear Reflectance (NLR) algorithm by NR for fractional snow cover (FSC) at mountain areas
- New features:
  - Improved accuracy for forested regions compared with current algorithms (e.g. NASA MODIS)
  - Enables longer time-series than MODIS
  - Enables higher performance than AVHRR (most AVHRR sensors do not include the 1.6 μm channel)
- Operational near real time service will be demonstrated during 2010/2011.



yellow – clouds
green – bare ground
white – snow cover

Products and Database

- **The selection of features and details of the SE and SWE products will be made based on the outcome of this Workshop**
  - Aggregation of daily products
    - Potentially e.g. monthly averages, weekly averages and sliding averages
  - Meta-data
  - Accuracy characteristics will be delivered for both products
    - Pixel-wise temporally changing statistical accuracies already available for the SWE product (error maps concurrent with SWE maps)
    - Additionally, evaluation of accuracies against independent reference data (both products): snow courses, station observations and high resolution reference images
- **30-year-long SWE and 15-year-long SE datasets will be made publicly available for the climate research community (FCDR)**
- **Demonstration of near-real-time product delivery**

Coverage of products

- **SWE**
  - Northern hemisphere, 35°- 85° (SWE for dry snow-covered non-alpine regions)
  - First demonstrations and protype data sets made for the whole region
- **SE**
  - Snow regions of both hemispheres:
    - 35° - 85° in northern hemisphere
    - Snowy mountain regions of southern hemisphere
  - Prototype dataset provided for the pan-European test region

Use of GlobSnow Products

- **Potential of products for different climate research applications**
  - Reference for climate models (model development and validation)
  - Input data for spatially distributed environmental/atmospheric process models
  - Climate trend analyses
    - As in case of climate model analyses, typically time-series from 25 to 30 years are required as the minimum
- **Product improvement possibilities after the GlobSnow?**
  - Temporal extension of SE time-series
  - Accuracy/confidence improvement of GlobSnow SWE and SE products
  - Improvement of spatial resolution characteristics
  - Fusion of SWE and SE products
  - Consideration of new instruments (e.g. Sentinel-series) and improvement of processing systems (e.g. AATSR geolocation inaccuracy)

Phases of the GlobSnow Project

- **Phase 1 (~2009)**
  - Testing and comparison of applicable approaches (for identified instruments)
  - Selection of SWE and SE mapping techniques, refinement of selected techniques
  - Production of prototype products with implemented prototype production lines
- **Phase 2 (~2010)**
  - Refinement of final product characteristics (considering the conclusions of the Innsbruck Workshop from the end of Phase 1)
  - FCDR production for SE and SWE with finalized production lines
- **Phase 3 (~2011)**
  - Demonstration of near-real-time services
  - Publicly open FCDR delivery on-going (and remains available after the project period)

Program of the WorkShop

Tuesday

Overview session Chair: Lothar Schüller (EUMETSAT)

- 13:30 Welcome (ENVEO) / Aim of the Workshop (ESA)
- 13:40 Overview of the GlobSnow Project (Jouni Pulliainen, FMI)
- 14:10 *WCRP and snow: yes and no(w)* (Vladimir Ryabinin, WMO/WCRP)
- 14:30 Overview of the GlobSnow SE Product (Rune Solberg, NR)
- 15:15 GlobSnow SAR Study (Thomas Nagler, ENVEO)
- 15:30 Coffee Break
- 16:00 Overview of the GlobSnow SWE Product (Kari Luojus, FMI)
- 16:45 Overview of the GlobSnow Near Real Time processing (Andreas Wiesmann, Gamma)
- 17:00 *Future missions for Cryosphere (*Michael Kern, ESA/ESTEC)
- 17:30 Ice Breaker

Wednesday morning

Algorithms session ***Chair: Michael Kern (ESA/ESTEC)***

- 9:00 Details on Snow Extent Product
  - SCAmod-method for Fractional snow cover mapping (Sari Metsämäki, SYKE)
  - SE Validation work (Rune Solberg, NR)
  - Investigating the Cloud masking approaches for GlobSnow (Thomas Nagler, ENVEO)
  - Potential GlobSnow SE aggregation product (Rune Solberg, NR)
  - Discussions
- 10:30 Coffee Break
- 11:00 Details on Snow Water Equivalent Product
  - Additional details on the SWE Validation work (Chris Derksen, EC)
  - Further features of the final SWE product and Possibilities for additional products (Jouni Pulliainen, FMI)
  - Aggregation of the SWE product (Kari Luojus, FMI)
  - Discussions
- 12:30 Lunch

Wednesday afternoon

User presentations Chair: Vladimir Ryabinin (WMO/WCRP)

- 14:00 *Snow Monitoring in Newfoundland and Labrador, Canada*
  Ali Khan, Government of Newfoundland and Labrador, Canada
- 14:15 *Toward assimilation of snow data*
  William Lahoz, Norwegian Institute for Air research (NILU), Norway
- 14:30 *Polar View Snow Services and Application in Hydrology*
  Florian Appel, Vista Remote Sensing in Geosciences GmbH, Germany
- 14:45 *SnowClim - the European snow climate monitoring programme of Deutscher Wetterdienst (DWD)*
  Peter Bissolli – Deutscher Wetterdienst (DWD), Germany
- 15:00 *GlobSnow product use within the ESA DUE Permafrost project*
  Annette Bartsch – Vienna University of Technology, Austria
- 15:15 *Snow products and activities in the EUMETSAT Network of Satellite Application Facilities*
  Lothar Schüller – EUMETSAT, Germany
- 15:30 Panel Discussion
- 16:00 Closing