Accuracy study of snow cover maps based on AVHRR data with different spatial resolution

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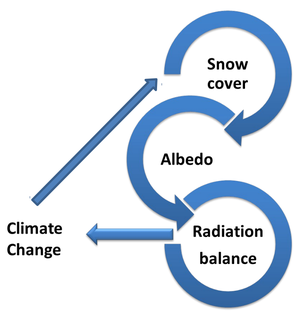
Introduction

Snow cover is a significant natural resource that influences hydrological processes, water management or snow-melt runoff.

Seasonal snow cover is crucial indicator of climatic variations. **GCOS** has declared **'Snow spatial extent'** as an **Essential Climate Variable** and emphasized the need for generating continuous satellite-based time series of daily snow cover products



The **Advanced Very High Resolution Radiometer (AVHRR)** provides a unique opportunity to retrieve a long time series of more than **35 years** to study Earth surface process at a global scale and on a **daily** basis.

Aims

The study aims to perform an accuracy assessment of snow cover maps derived from AVHRR Local Area Coverage (LAC) and Global Area Coverage (GAC) datasets for the time period of 2002 and 2003 from the same National Oceanic and Atmospheric Administration-16 (NOAA) satellite.

Data and study area

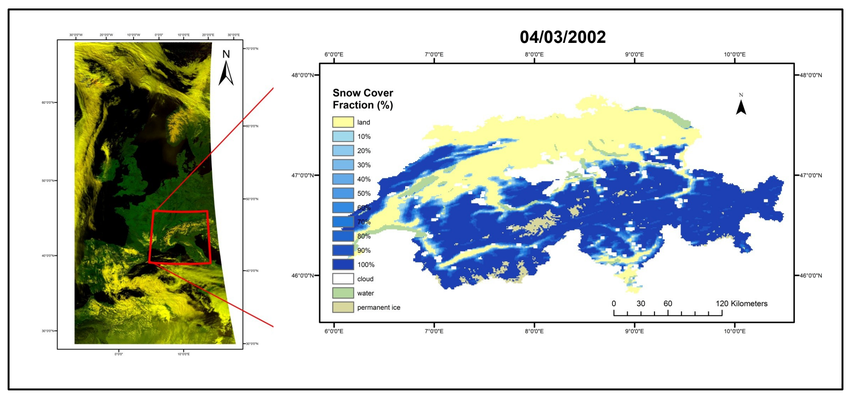


Figure 1: Location of Study Area

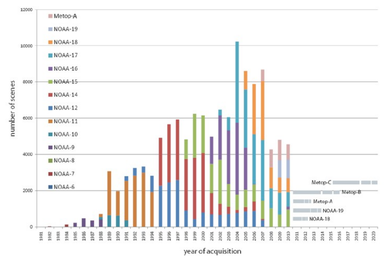


Figure 2 The AVHRR data volume collected at the University of Bern illustrated by satellite mission and acquisition year. (Hüsler et al., 2011)

- Daily snow cover fraction (SCF) of 1.1km LAC data including a probability cloud mask (PCM) are processed based on the archive of the Remote Sensing Group Bern (RSGB).
- Auxiliary data (water mask, permanent ice and snow mask) are used from the ESA CCI Landcover project for the year 2000.
- Elevation (SwissALTI3D) and landcover (Arealstatistik) information are available for the study area at high resolution.
- SCF data based on GAC data are obtained in the frame of the ESA CCI+ Snow project.

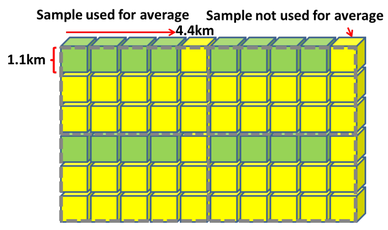


Figure 3: Sampling scheme for AVHRR LAC& GAC data (Pinheiro et al. 2006)

Methodology

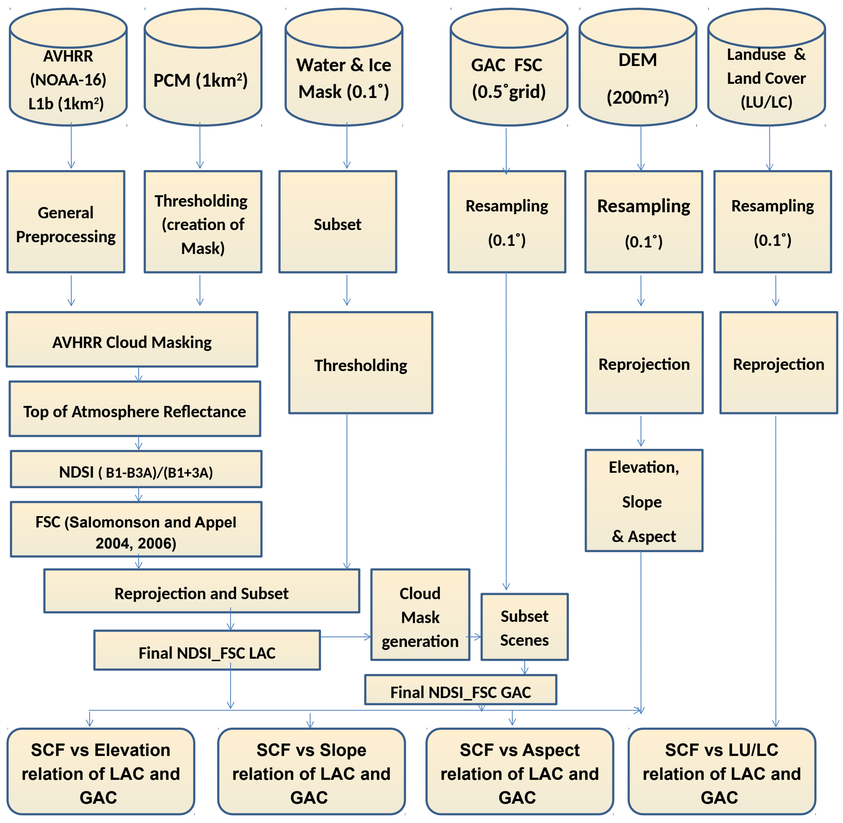
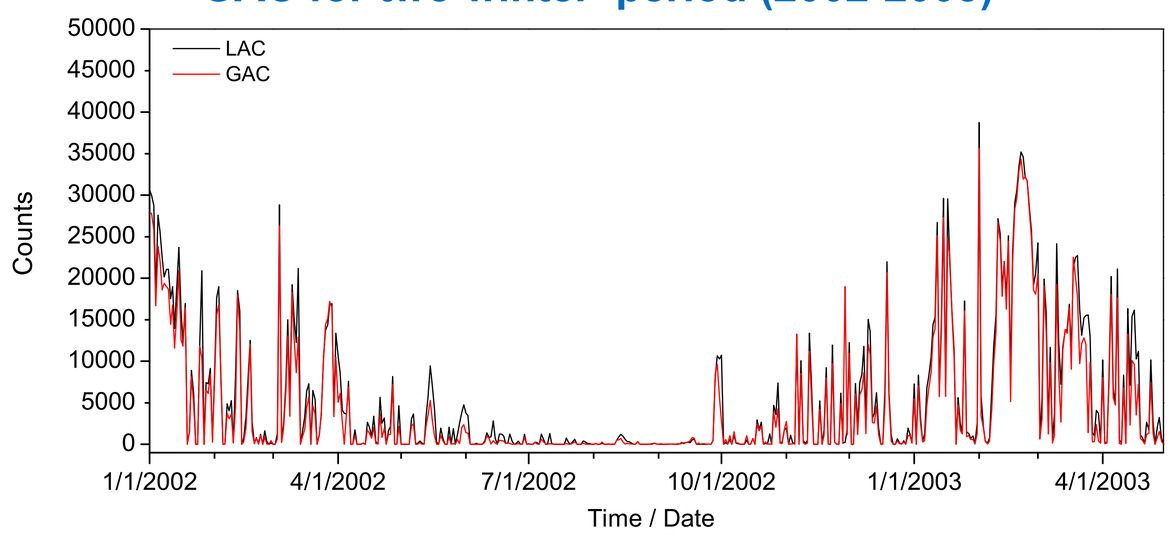


Figure 4: Flowchart of the methodology

Time series of Total Snow Cover Fraction from LAC & GAC for two winter period (2002-2003)

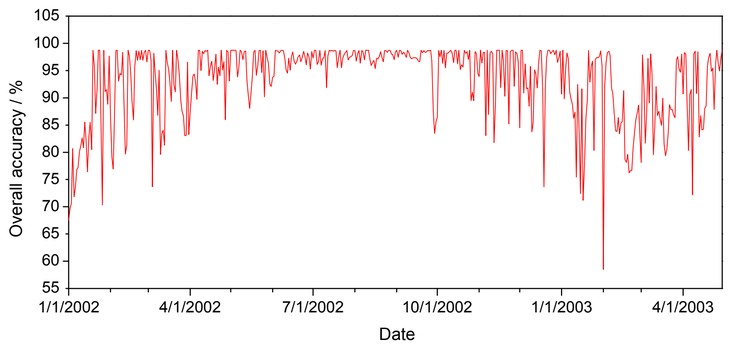


Classification Report of 04/03/2002

	precision	recall	f1-score	support
0	0.84	0.97	0.90	62162
1	0.03	0.00	0.01	928
2	0.05	0.01	0.01	727
3	0.01	0.00	0.01	692
4	0.03	0.02	0.02	636
5	0.01	0.00	0.00	676
6	0.00	0.00	0.00	760
7	0.01	0.01	0.01	911
8	0.02	0.02	0.02	1255
9	0.06	0.05	0.05	2222
10	0.84	0.55	0.66	20031
accuracy			0.78	91000
macro avg	0.17	0.15	0.15	91000
weighted avg	0.76	0.78	0.76	91000

Table 1 : Classification report of one clear day of Study area (1-10 [10-100%] = SCF and 0=non snow class)

Classification Accuracy LAC & GAC (including water,permanent ice, nonsnow & cloud)



Topographic Influence

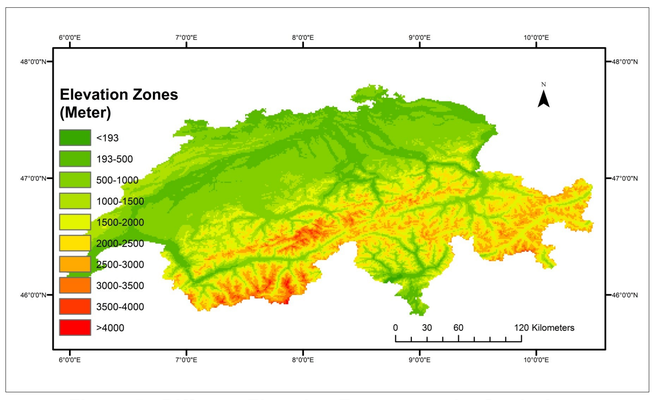


Figure 5 : Different Elevation Zones over the Study Area

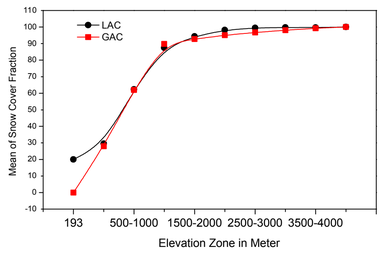


Figure 6 : Mean Snow Cover Fraction variability of 04/03/2002 LAC & GAC in different Elevation Zones

Reference

1. Salomonson, V.V., & Appel, I. (2004). Estimating fractional snow cover from MODIS using the normalized difference snow index. *Remote Sensing of Environment, 89*, 351-360
2. Salomonson, V.V., & Appel, I. (2006). Development of the Aqua MODIS NDSI fractional snow cover algorithm and validation results. *IEEE Transactions on Geoscience and Remote Sensing, 44*, 1747-1756

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