GlobSnow SAR Snow Mapping Study

GlobSnow User WorkShop 1 – Innsbruck

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GlobSnow Snow Extent (SE) Product

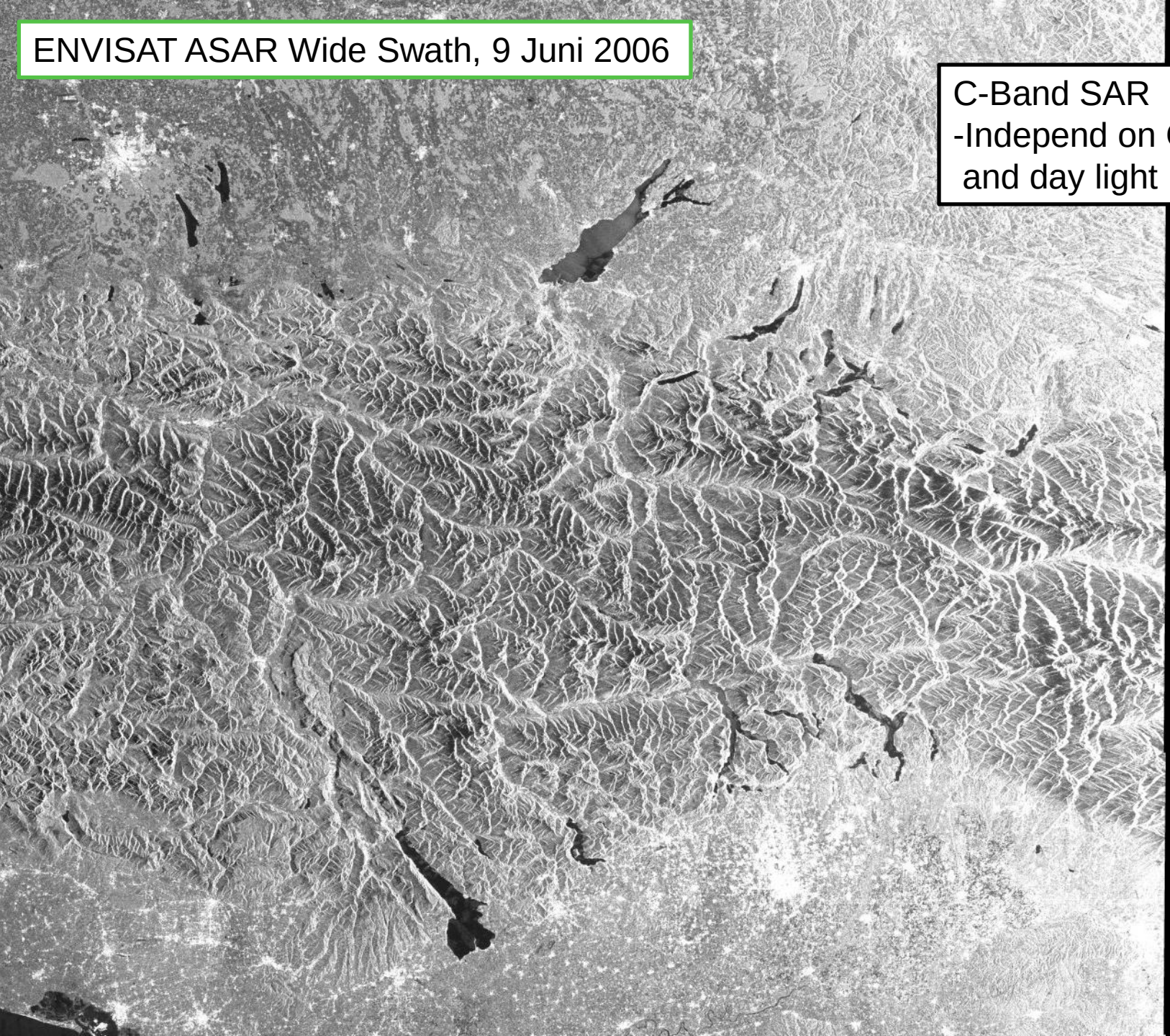
Optical satellite data is the primary data source for generating the global GlobSnow SE product.

OBJECTIVE OF GLOBSNOW SAR STUDY

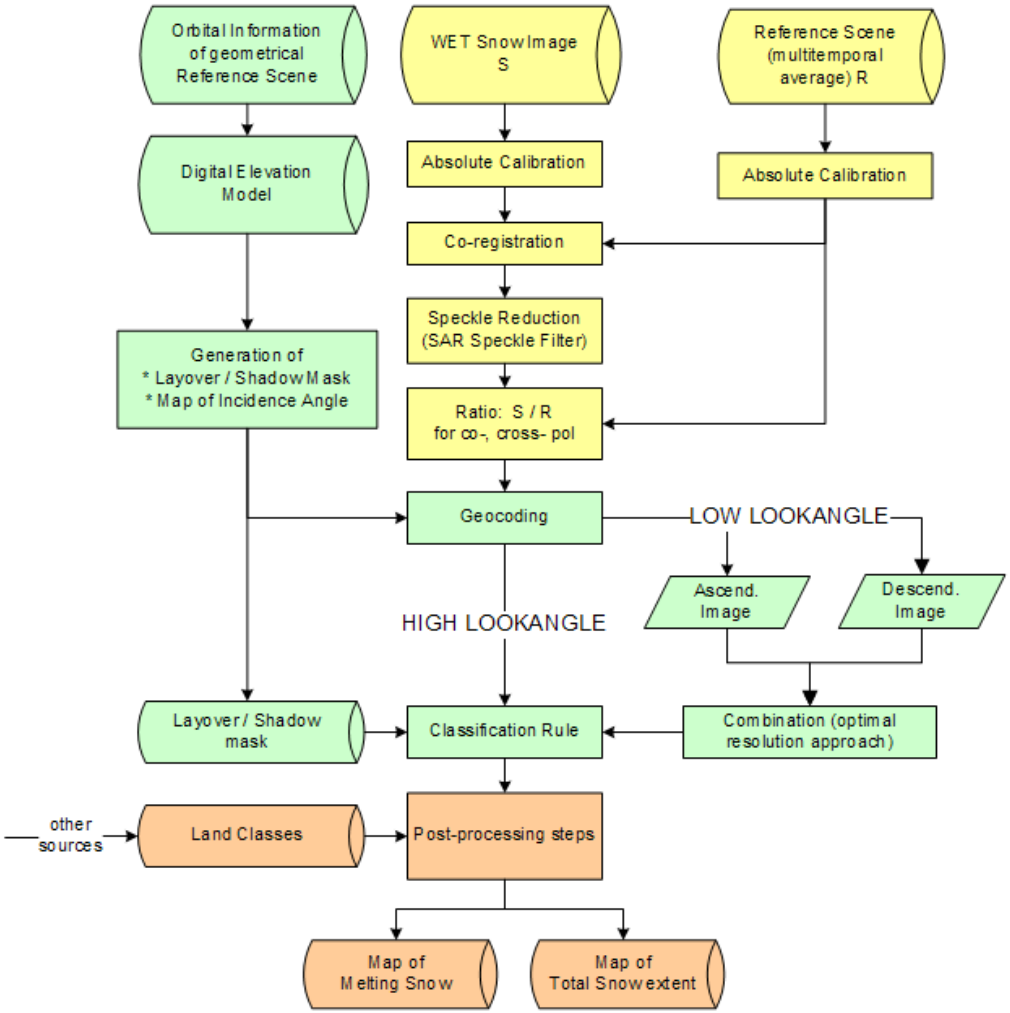
Investigate the capabilities and limitations of available SAR sensors for improving the GLOBSNOW SE products

Contents

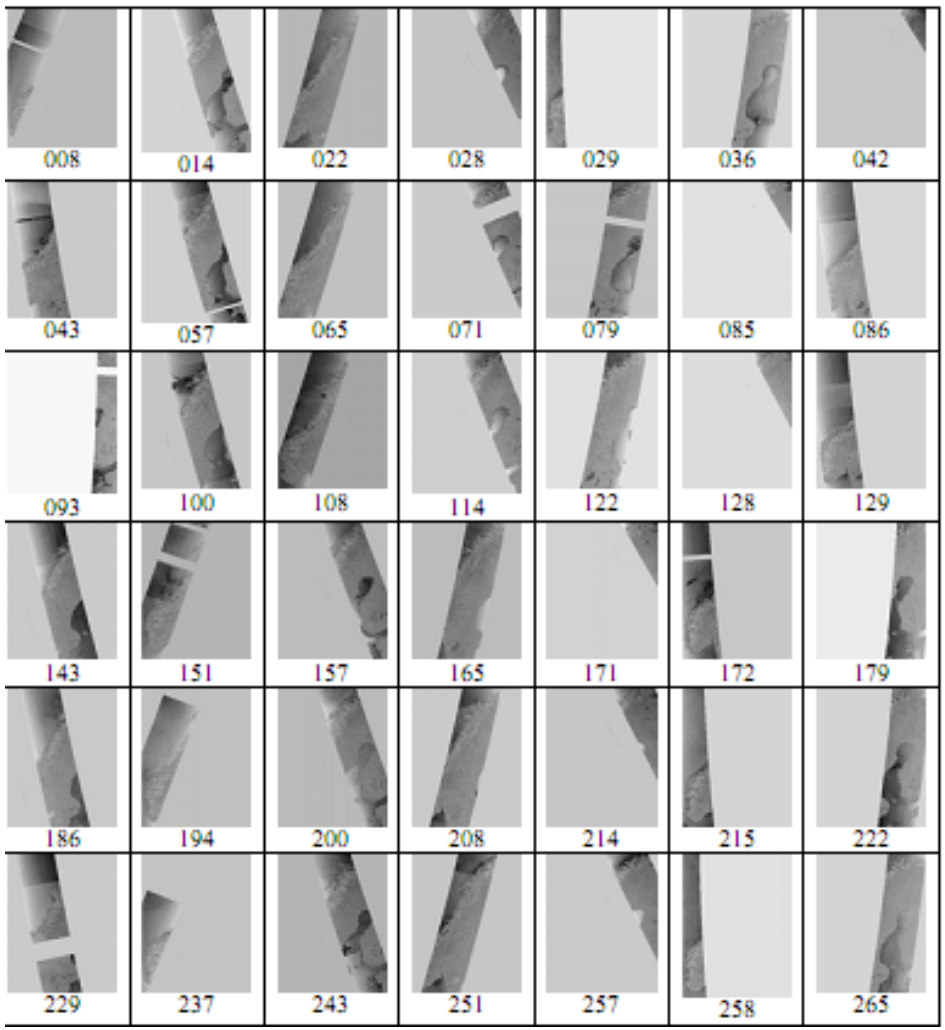
- **SAR Snow Mapping Processing Line**
- **Multi-Sensors Processing Line**
- **Examples of SAR Snow Maps**
  - Scandinavia
  - Alps
- **Capabilities and Limitations of SAR Snow Mapping in GlobSnow**

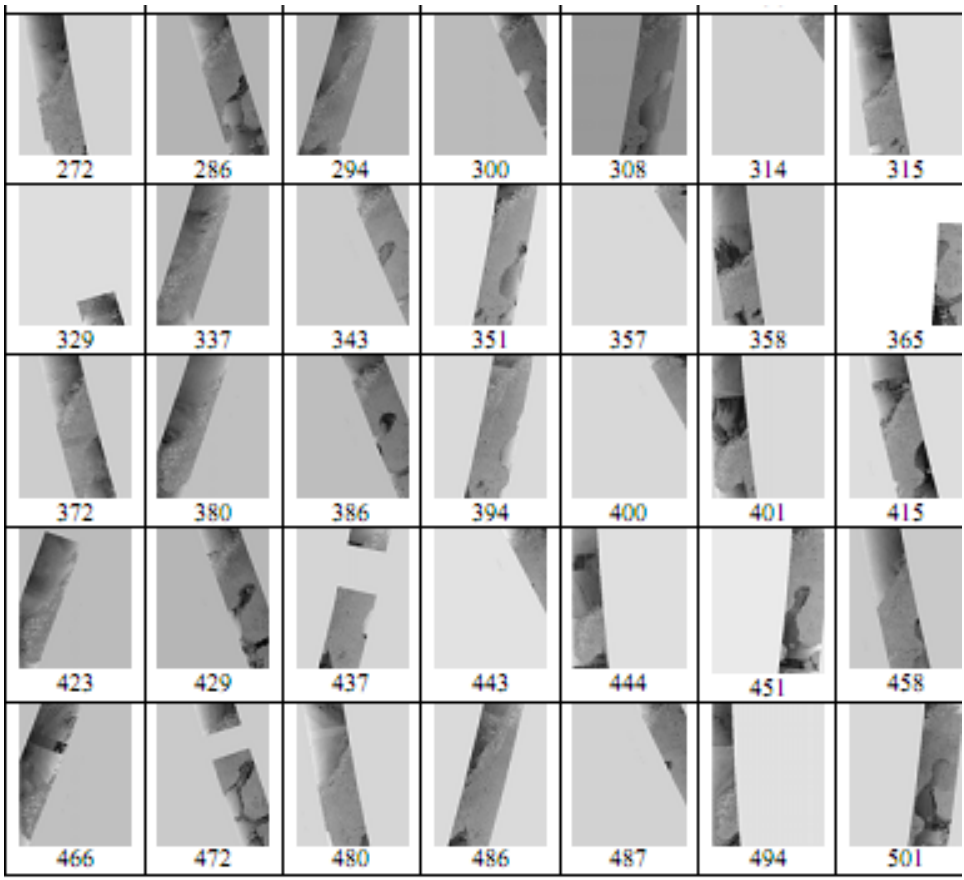

ENVISAT ASAR Wide Swath, 9 Juni 2006
C-Band SAR
-Independ on Clouds
and day light

SAR Wet Snow Detection



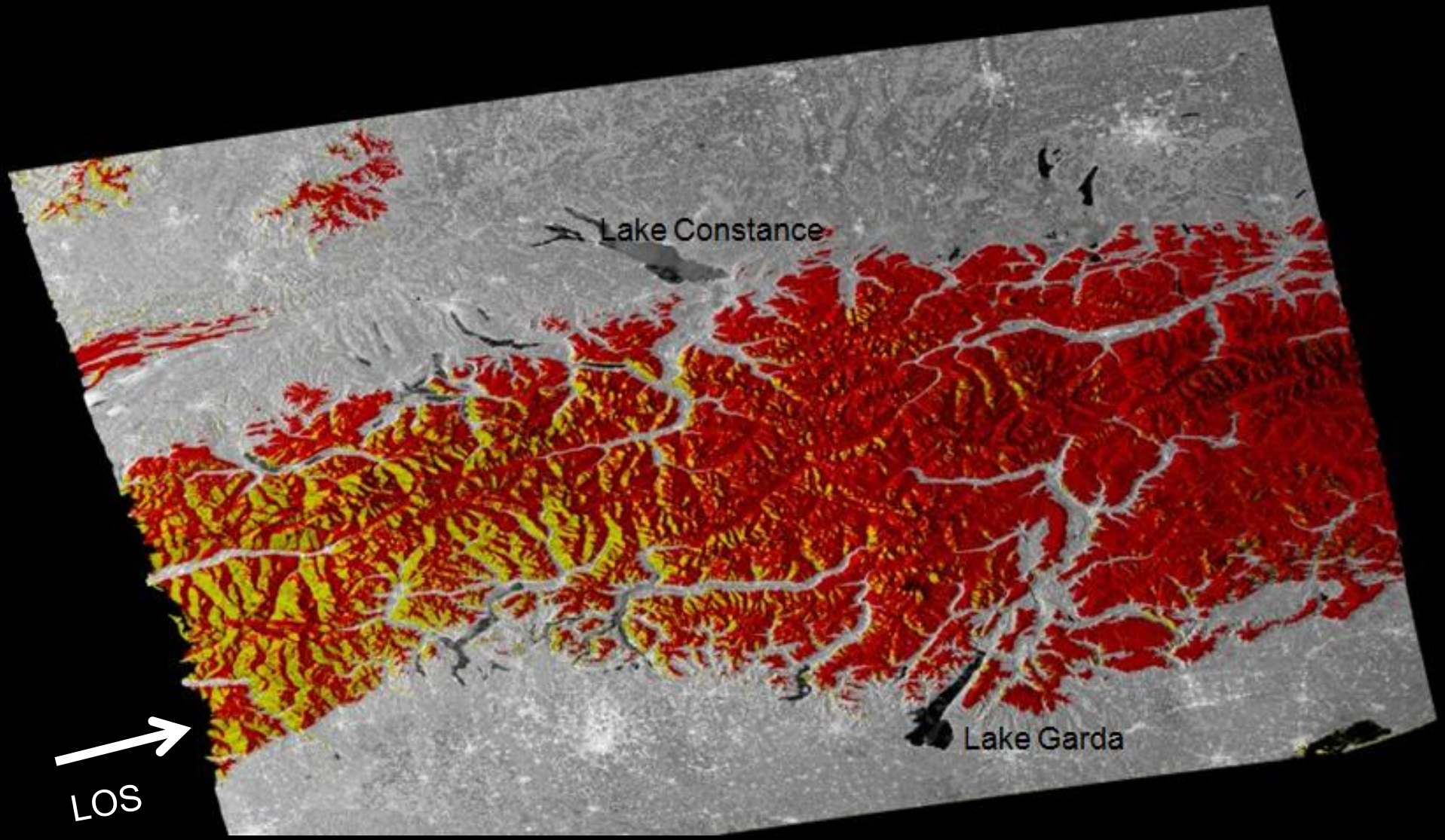
Reference scene library - Scandinavia





(77 tracks in use)

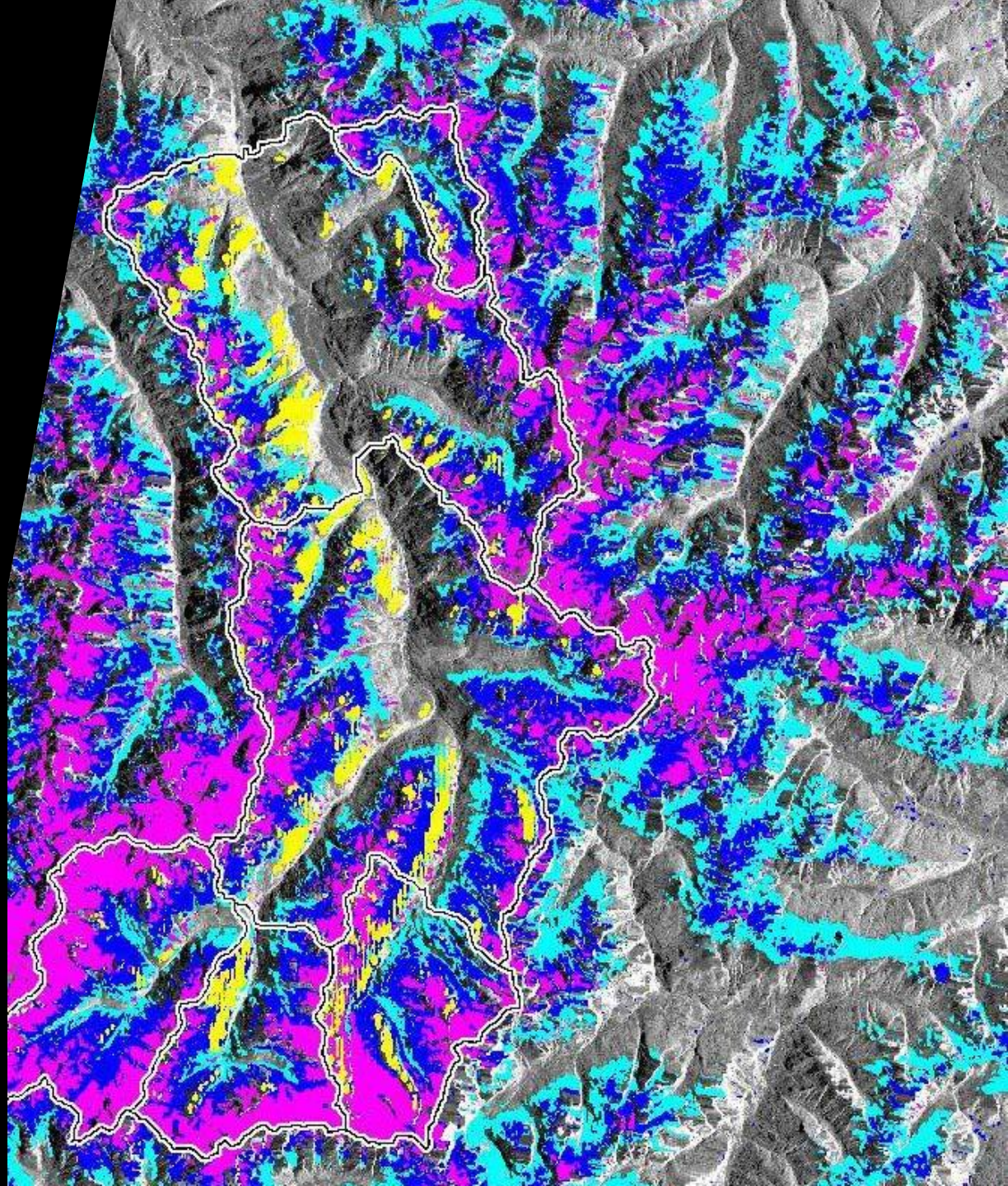
ENVISAT ASAR, WS, 9 June 2006



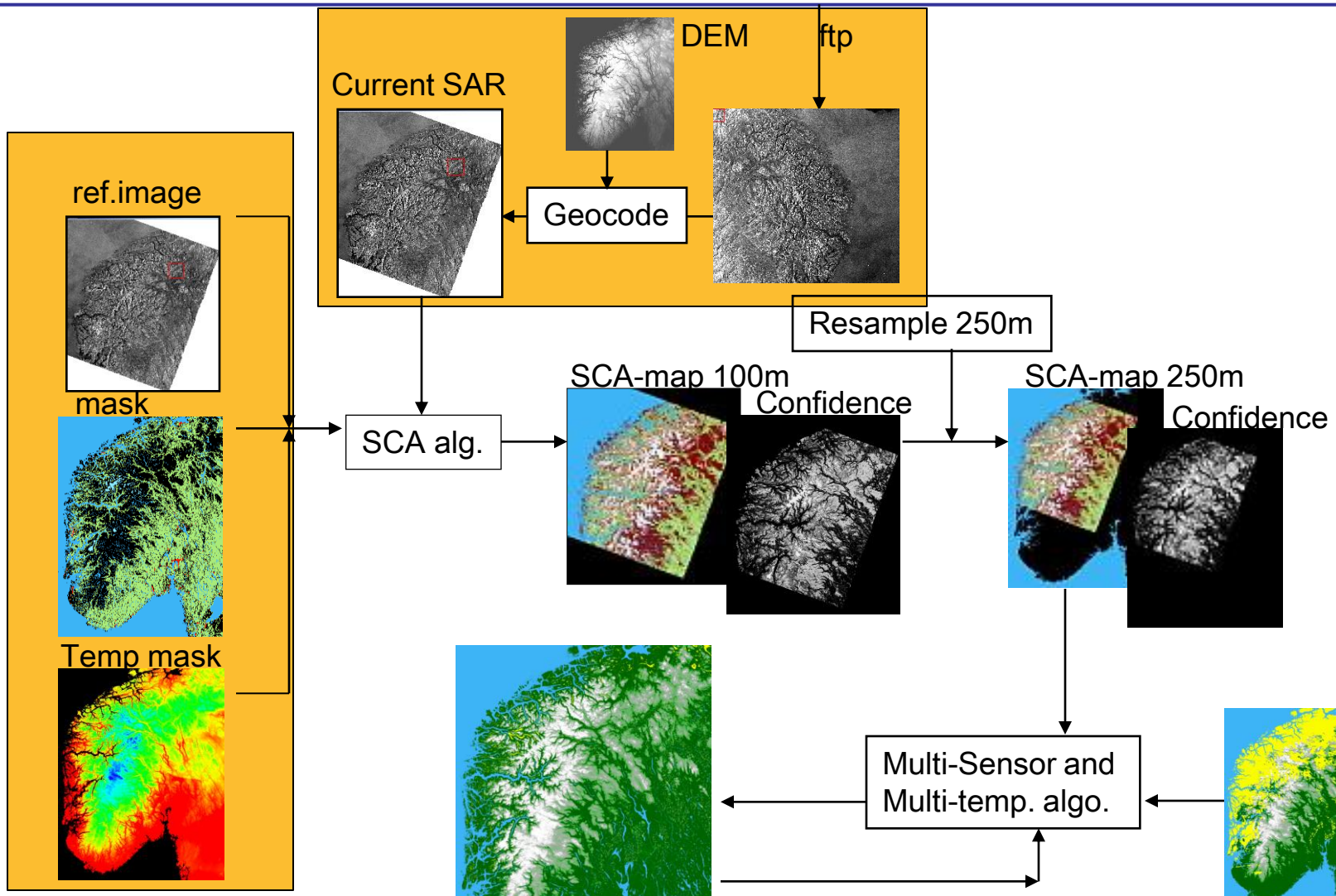
ENVISAT Multitemporal Snow Map IS6 40° Incidence Angle

4 May 2004
8 June 2004
14 July 2004

Yellow: Layover
(6.8 % of area)

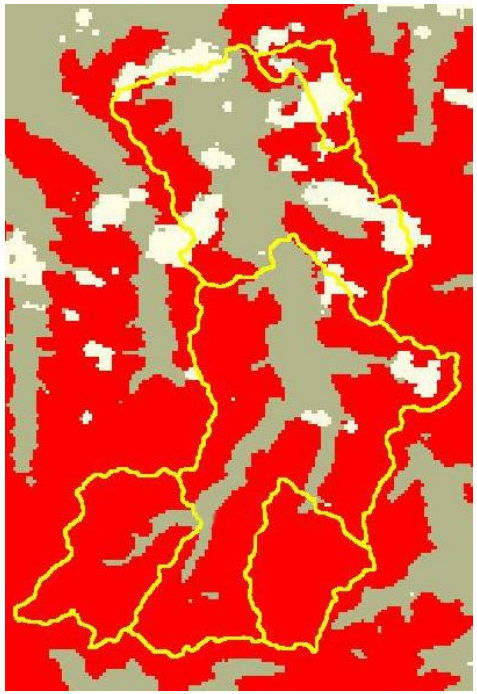


Multi-Sensor Snow Maps

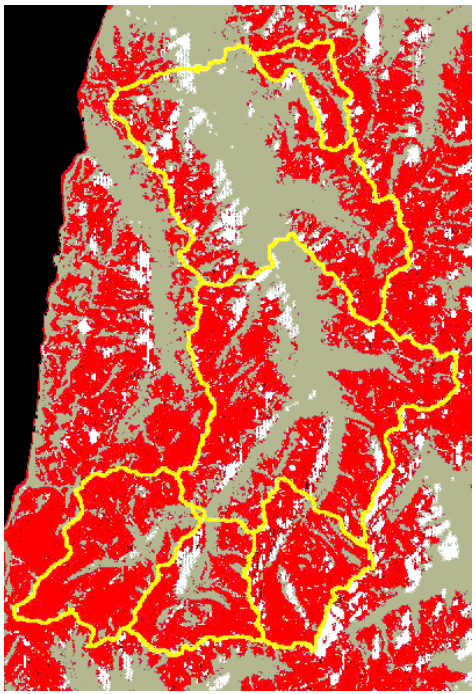


Comparison SAR – Optical Snow Maps, Alps

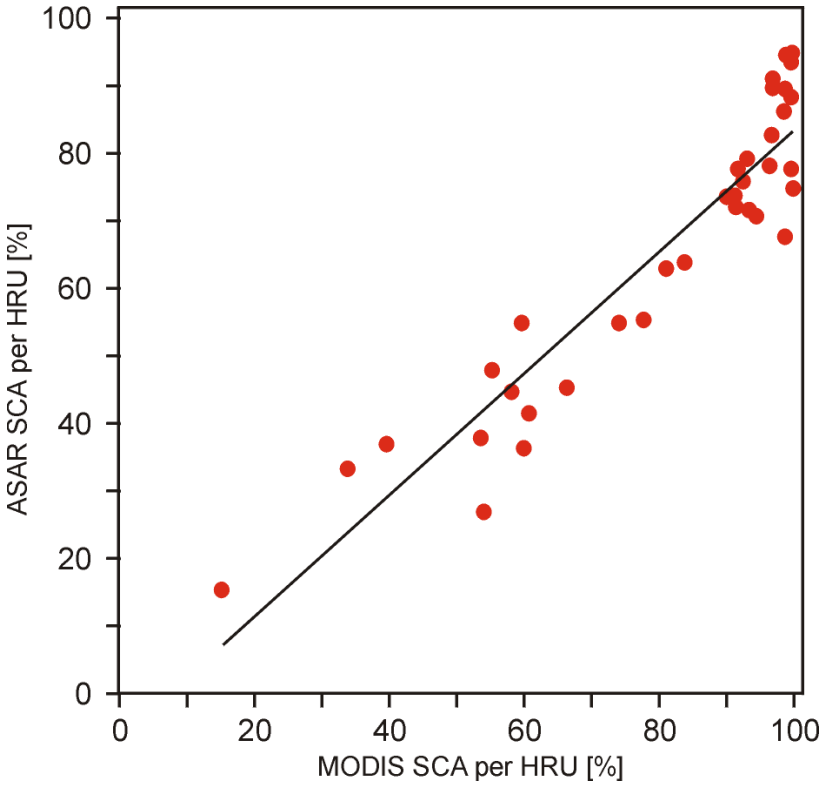
SCA [ASAR] = 0.90 SCA[MODIS] - 6.7



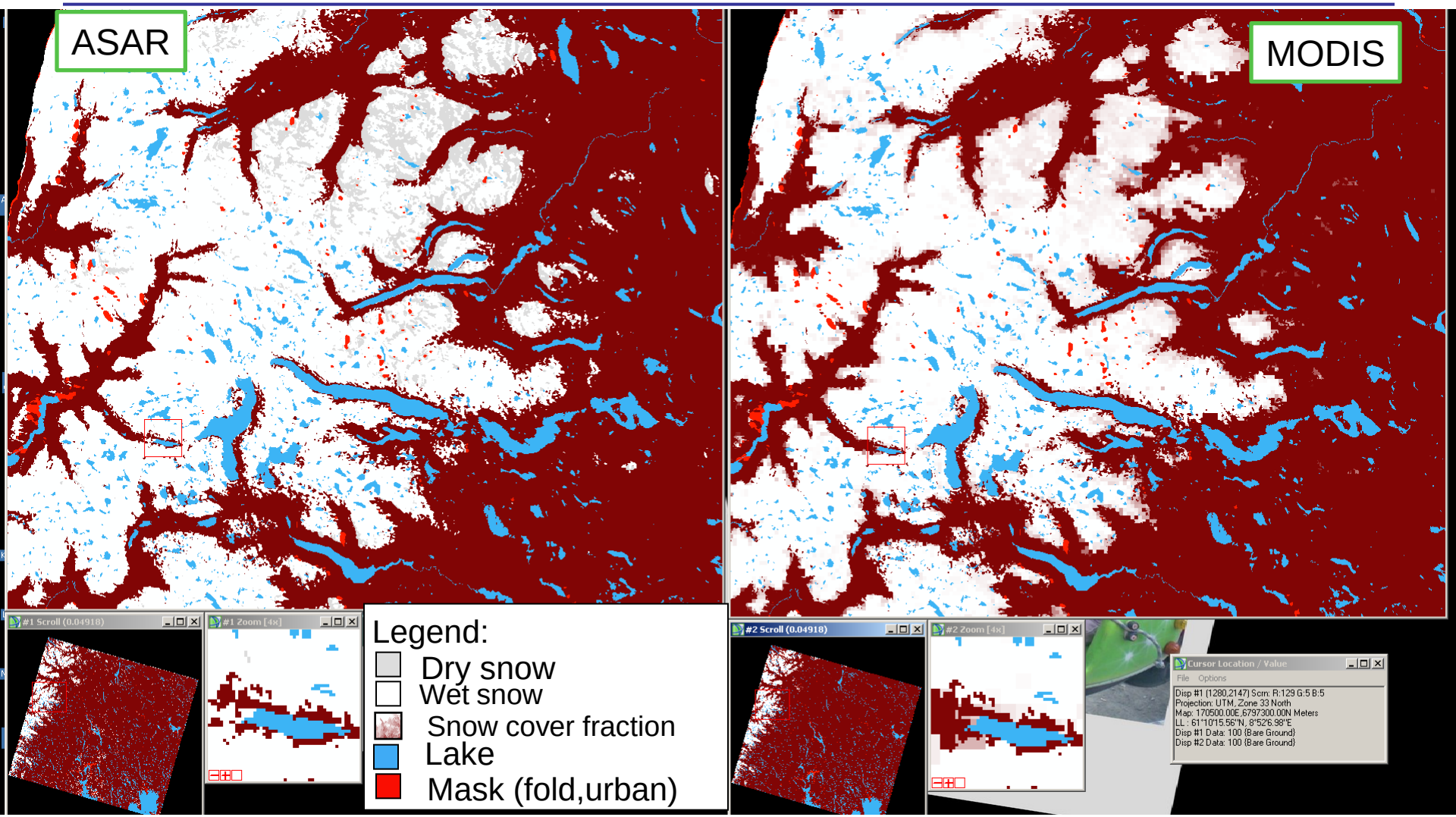
MODIS
19 May 2004



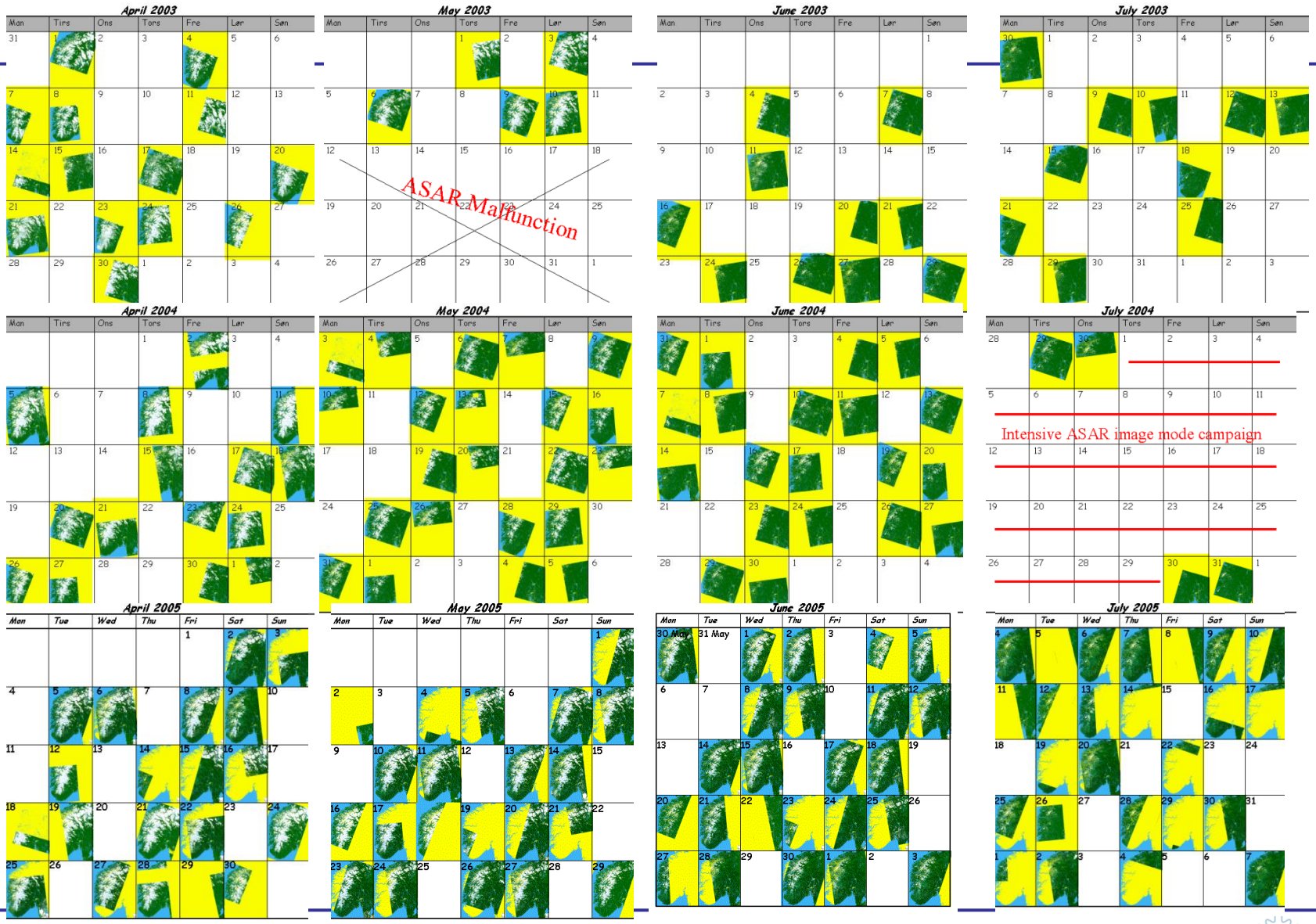
ENVISAT ASAR IS-7
20 May 2004



Comparison SAR – Optical Snow Maps



Time Series of Snow Maps – Scandinavia Melting period 2003, 2004, 2005



Capabilities and Limitations 1/2

- C-Band SAR enables mapping of wet snow irrespective of solar illumination and cloudiness. Dry snow and bare ground have similar backscatter signatures and cannot be discriminated.
- As C-Band SAR is sensitive only to wet snow post-processing rules have to be applied in order to infer the total (dry and wet) snow extent. Snow post-processing rules have to be adapted for different environments.
- In dense forests SAR snow mapping is not applicable.
- Automatic procedures for mapping snow extent on a local to regional scale for alpine areas and nordic boreal forested areas are available.
- SAR based algorithms tend to underestimate the snow extent in comparison to optical images especially in areas with patchy snow cover.
- SAR snow mapping on a continental (or hemispheric) scale requires huge data storage and computational capacities. Due to the multi-temporal nature of the algorithms powerful data handling capabilities are needed (including the selection and generation of reference images for each SAR track and frame).

Capabilities and Limitations 2/2

- The generation of FDCRs requires systematic acquisition of data over a >15 year time period and hemispheric coverage. This is not the case even by combining the C-Band SAR systems ERS, ENVISAT ASAR and Radarsat. There are large gaps the global SAR data base, both in area and time, prohibiting the use for production of consistent global snow maps of multi-year periods.
- In selected areas (like Scandinavia) ASAR has acquired data quite densely due to the background mission. In these areas it should be possible to reconstruct time series of SE-maps (wet snow map; total snow cover is retrieved by applying post-processing rules). This can improve the times series of SE-maps for regions where clouds are very frequent. However, for the pre-ASAR period (before 2002) the coverage is very sparse.
- With the launch of Sentinel-1 the availability of SAR data will improve, as a systematic data acquisition strategy is planned.