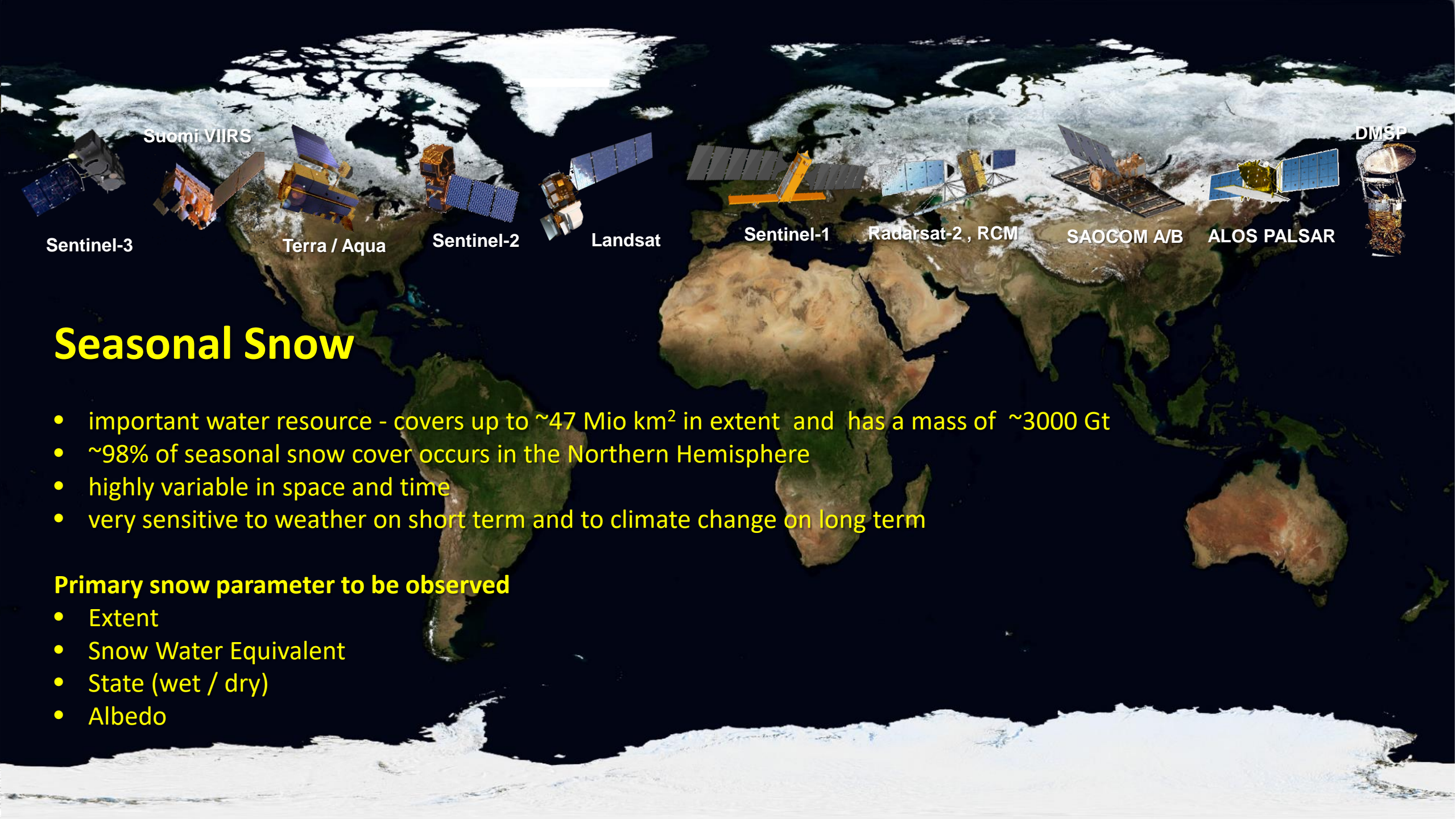


Beitrag von Satelliten zur effizienten Nutzung der Wasserressourcen in der Energiewirtschaft Analysis

Thomas Nagler, ENVEO



Fachdialog „Die Energiewende proben – (wie) geht das?“
Workshop *Weltraumdaten & -services für die Energiewende*, 30 März 2022



Seasonal Snow

- important water resource - covers up to ~ 47 Mio km² in extent and has a mass of ~ 3000 Gt
- $\sim 98\%$ of seasonal snow cover occurs in the Northern Hemisphere
- highly variable in space and time
- very sensitive to weather on short term and to climate change on long term

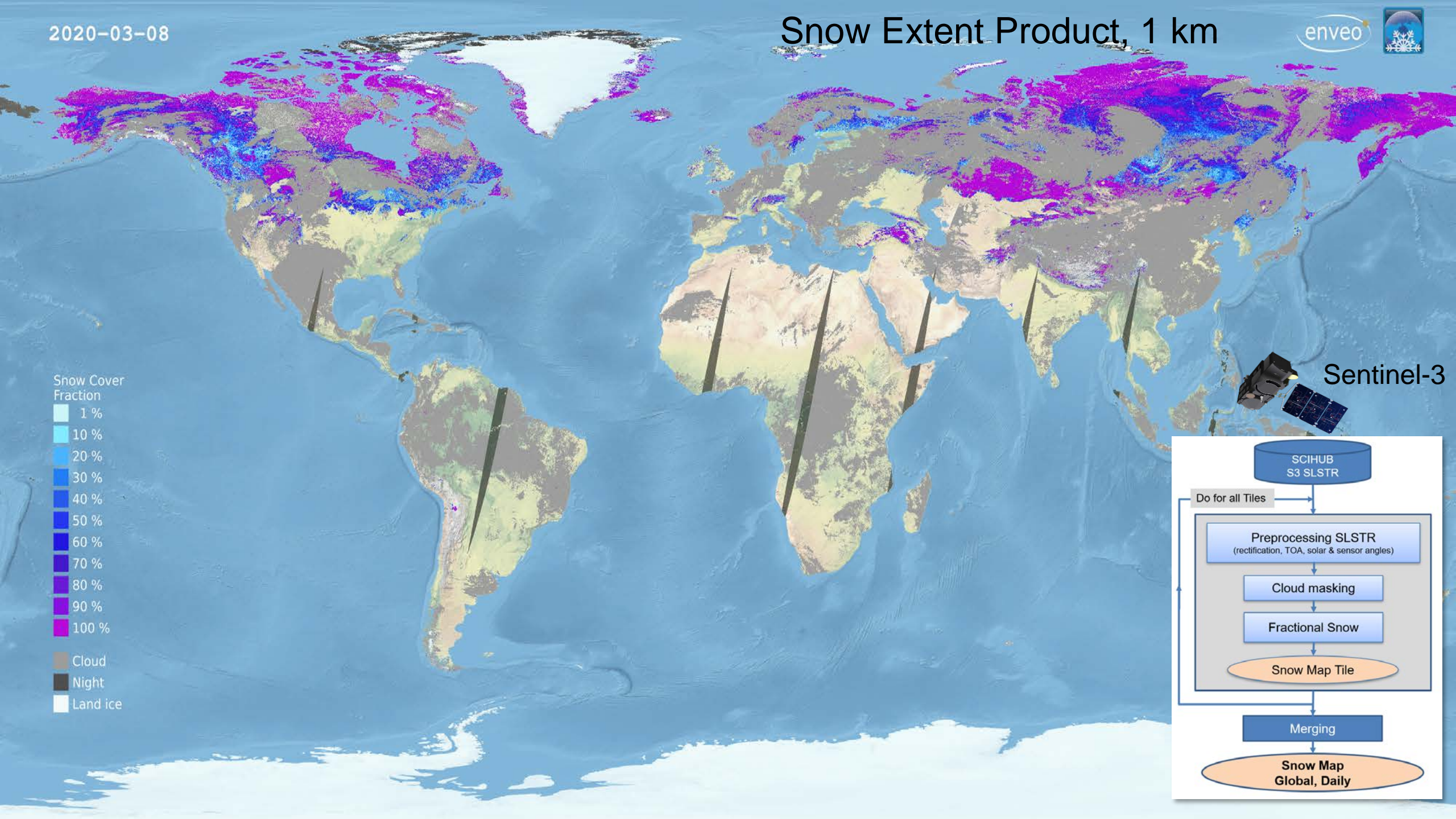
Primary snow parameter to be observed

- Extent
- Snow Water Equivalent
- State (wet / dry)
- Albedo



2020-03-08

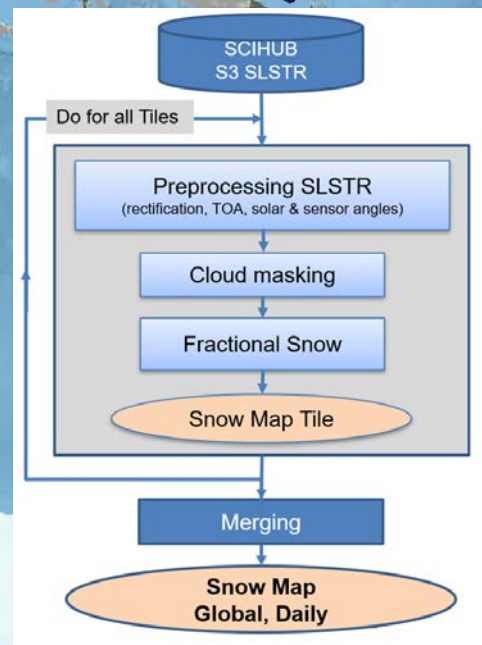
Snow Extent Product, 1 km



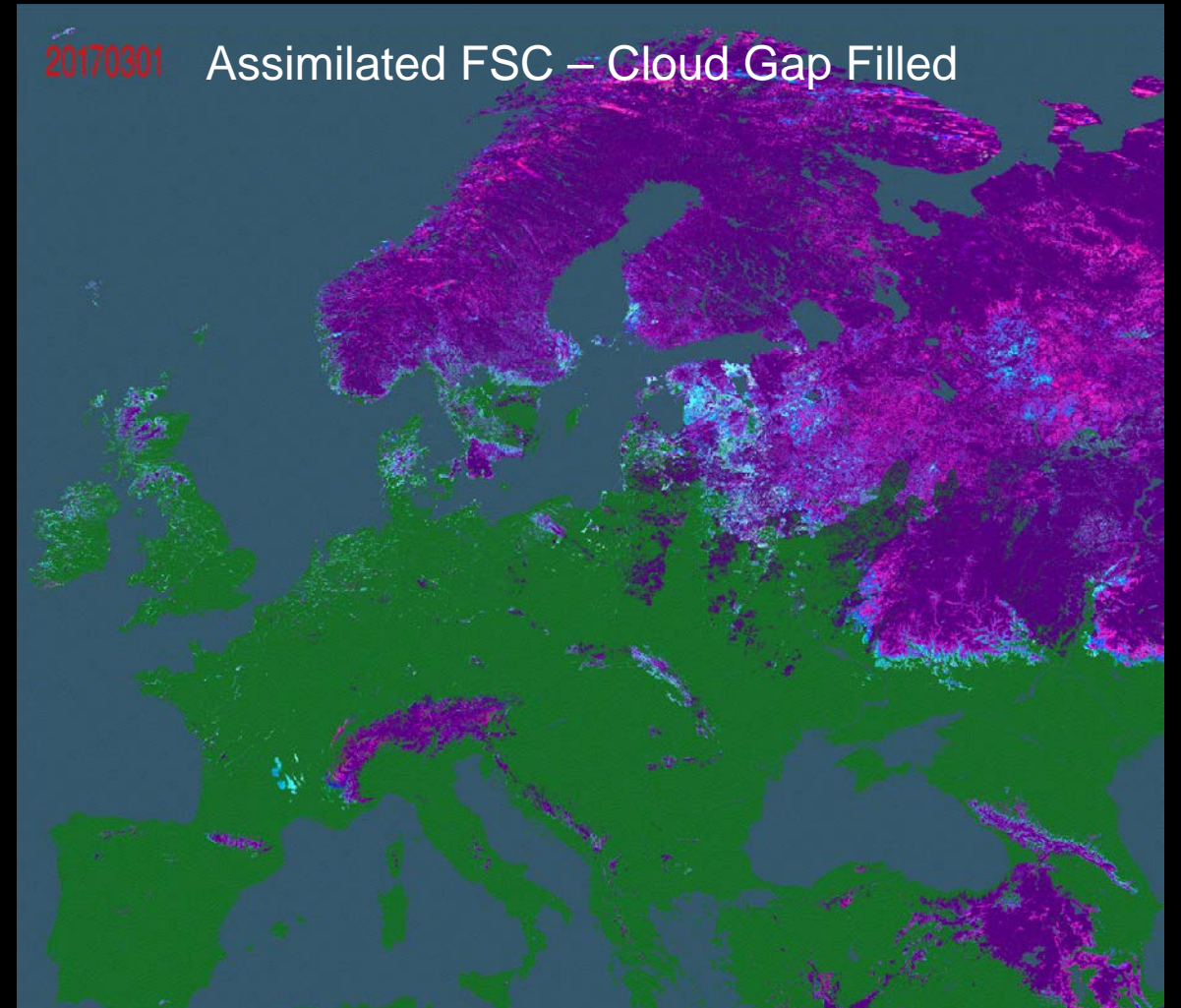
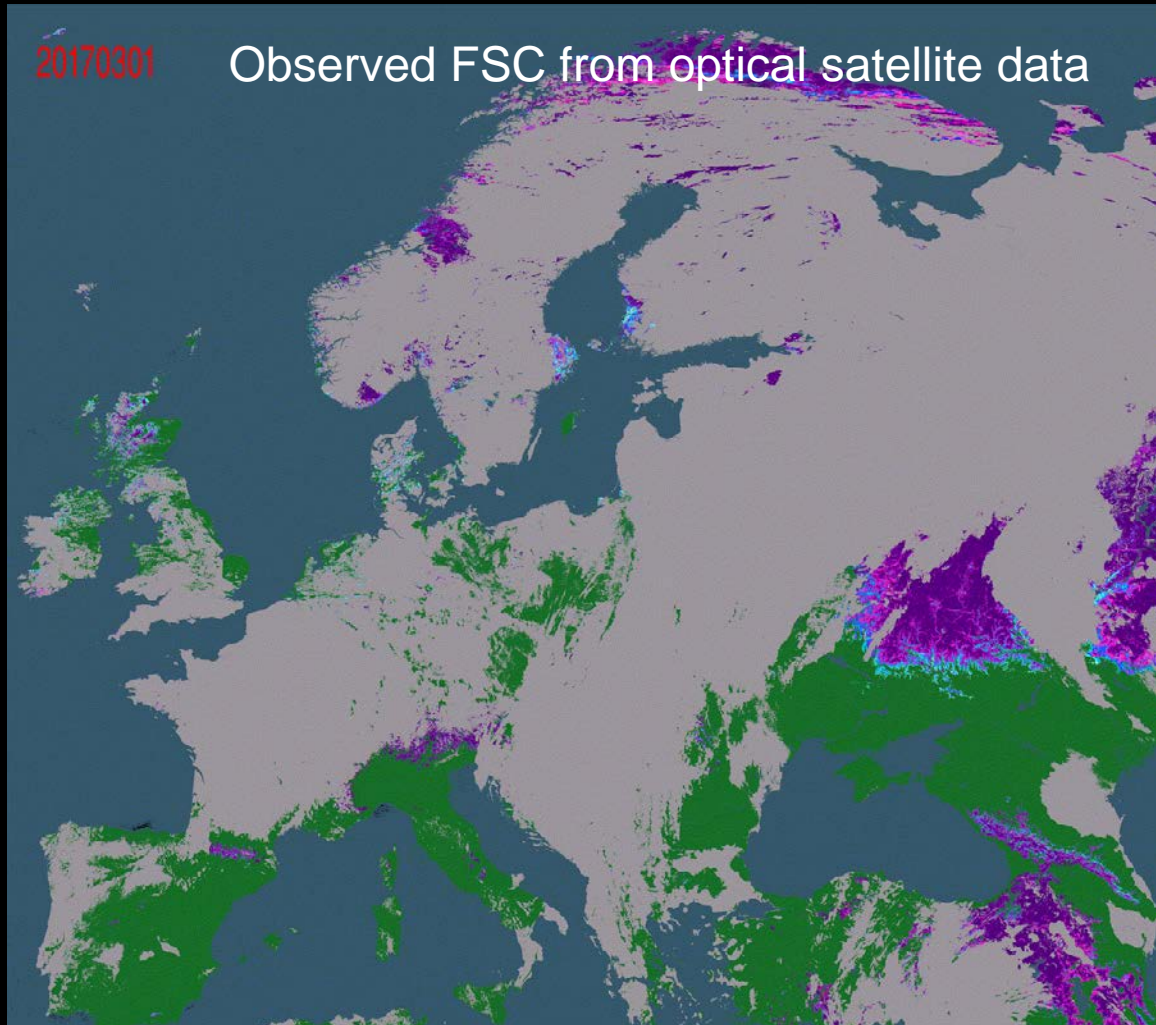
- Snow Cover Fraction
- 1 %
 - 10 %
 - 20 %
 - 30 %
 - 40 %
 - 50 %
 - 60 %
 - 70 %
 - 80 %
 - 90 %
 - 100 %
- Cloud
Night
Land ice



Sentinel-3

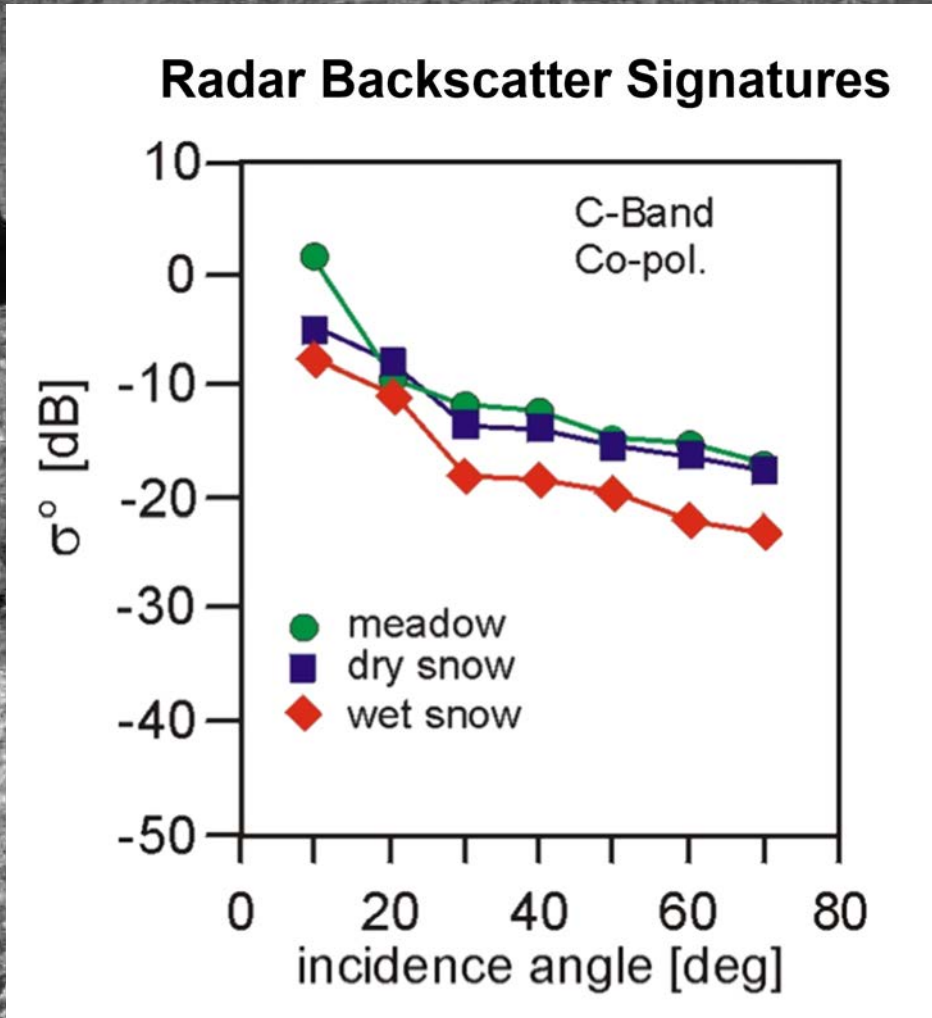
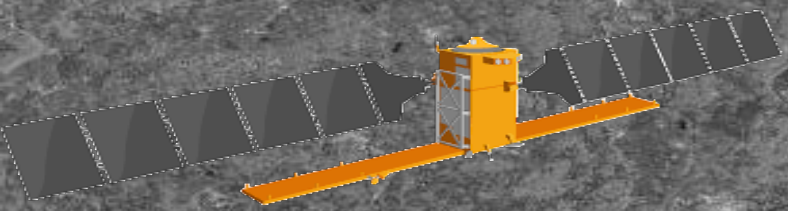


Cloud-gap filling of optical Snow Extent Products



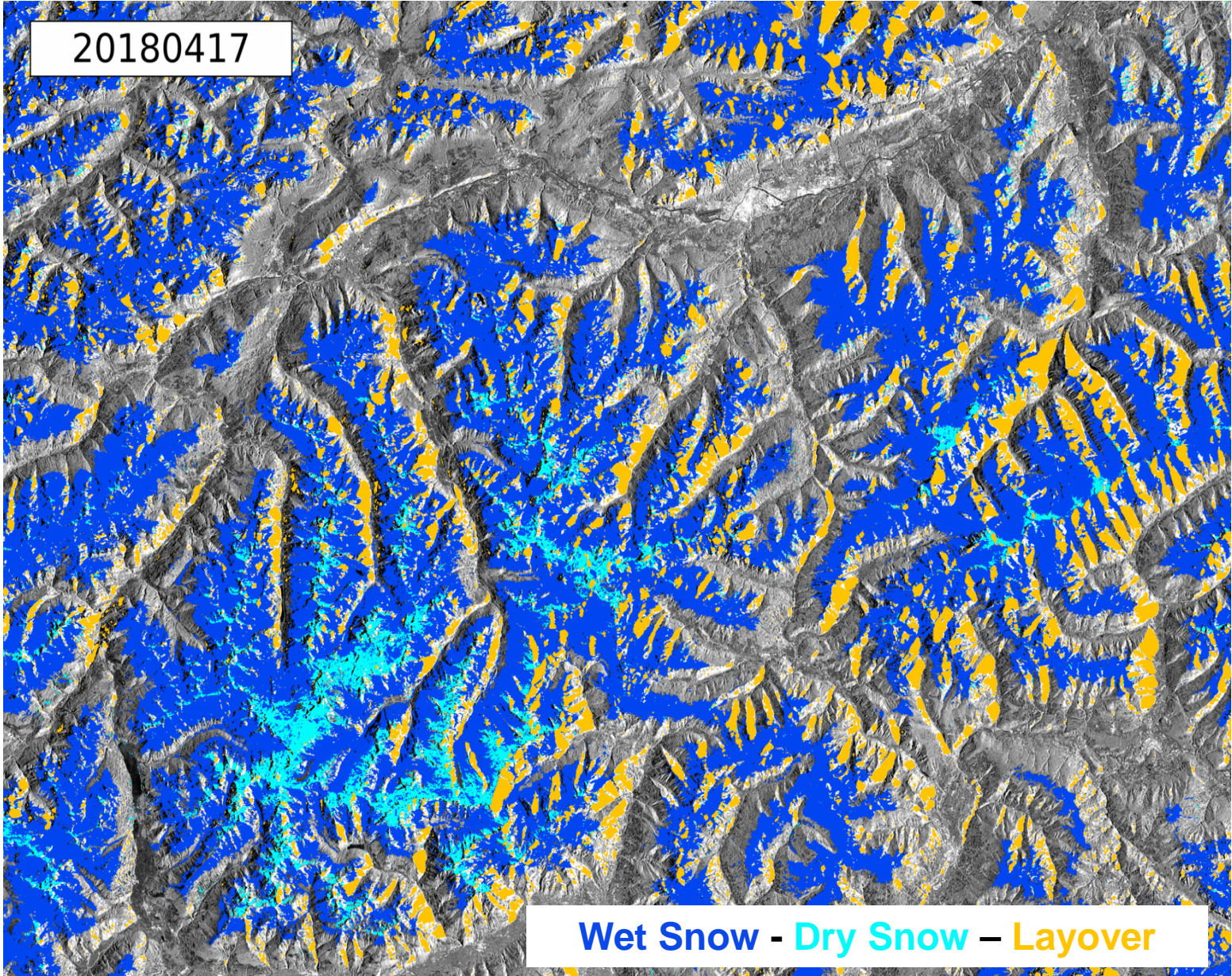
To fill gaps in the time sequence of optical FSC maps due to cloudiness we apply a data assimilation procedure using a snow pack model, driven by data from numerical meteorological models, for estimating daily changes in the snow extent in cloudy areas. (300 – 500 m pixel-spacing)

Sentinel-1 SAR – Alps

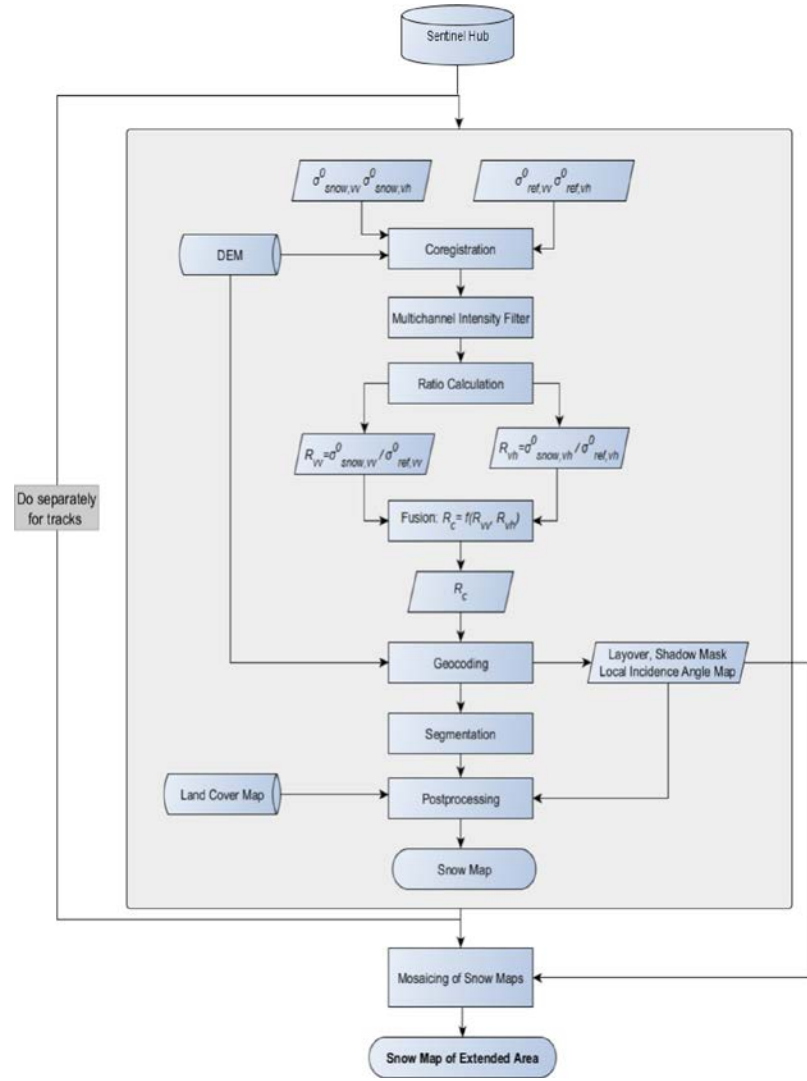


Innsbruck

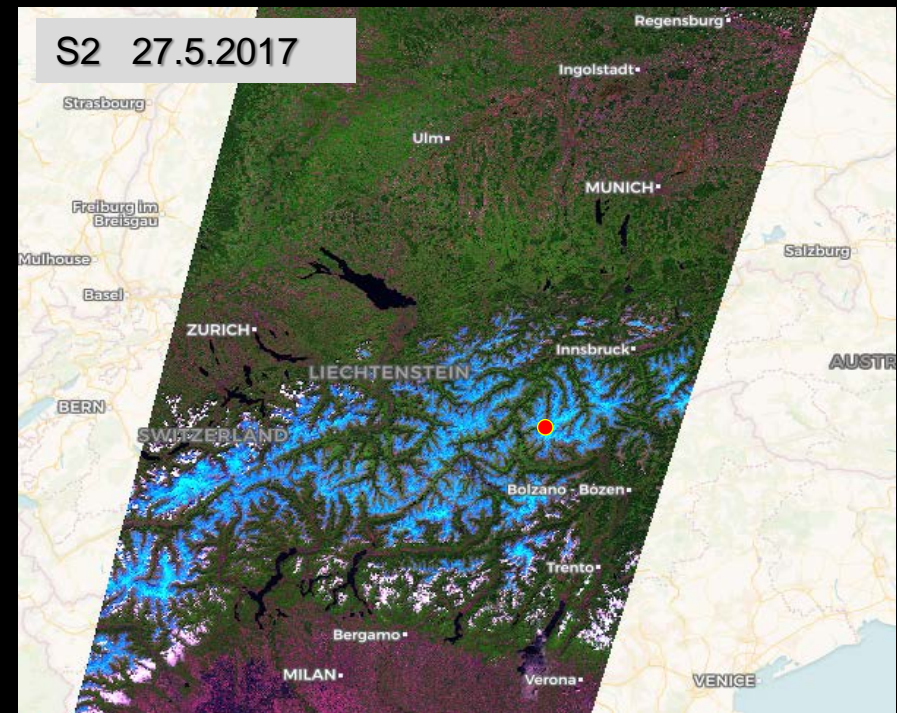
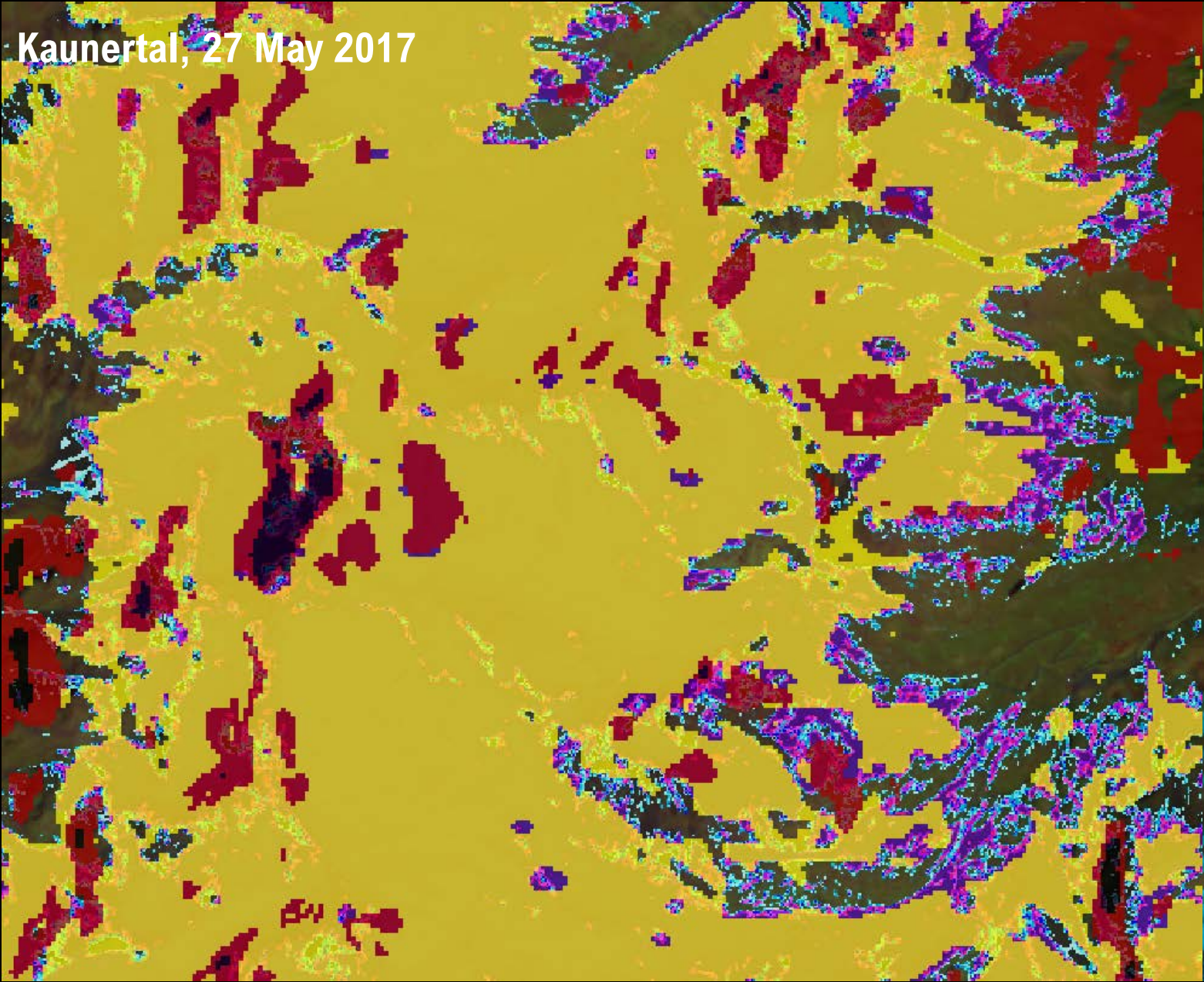
Wet Snow Detection from Sentinel-1 SAR Data



Generation of Wet Snow Product



HR Snow Cover and Melt Extent from Optical and SAR Satellites



Sentinel-2 snow product

- Fractional Snow Cover
- 10 m pixel

S1 Snow Melt product:

- binary
- 20 m pixel

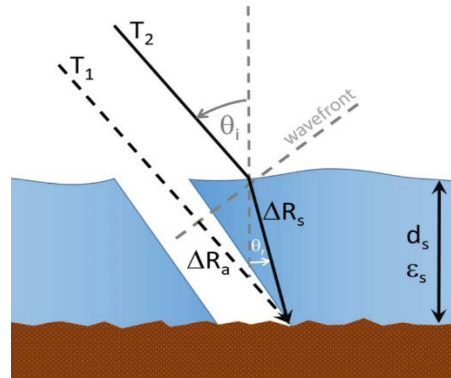
S1 - Wet snow Radar shadow no data

Snow Water Equivalent Map in Mountains using SAR Interferometry

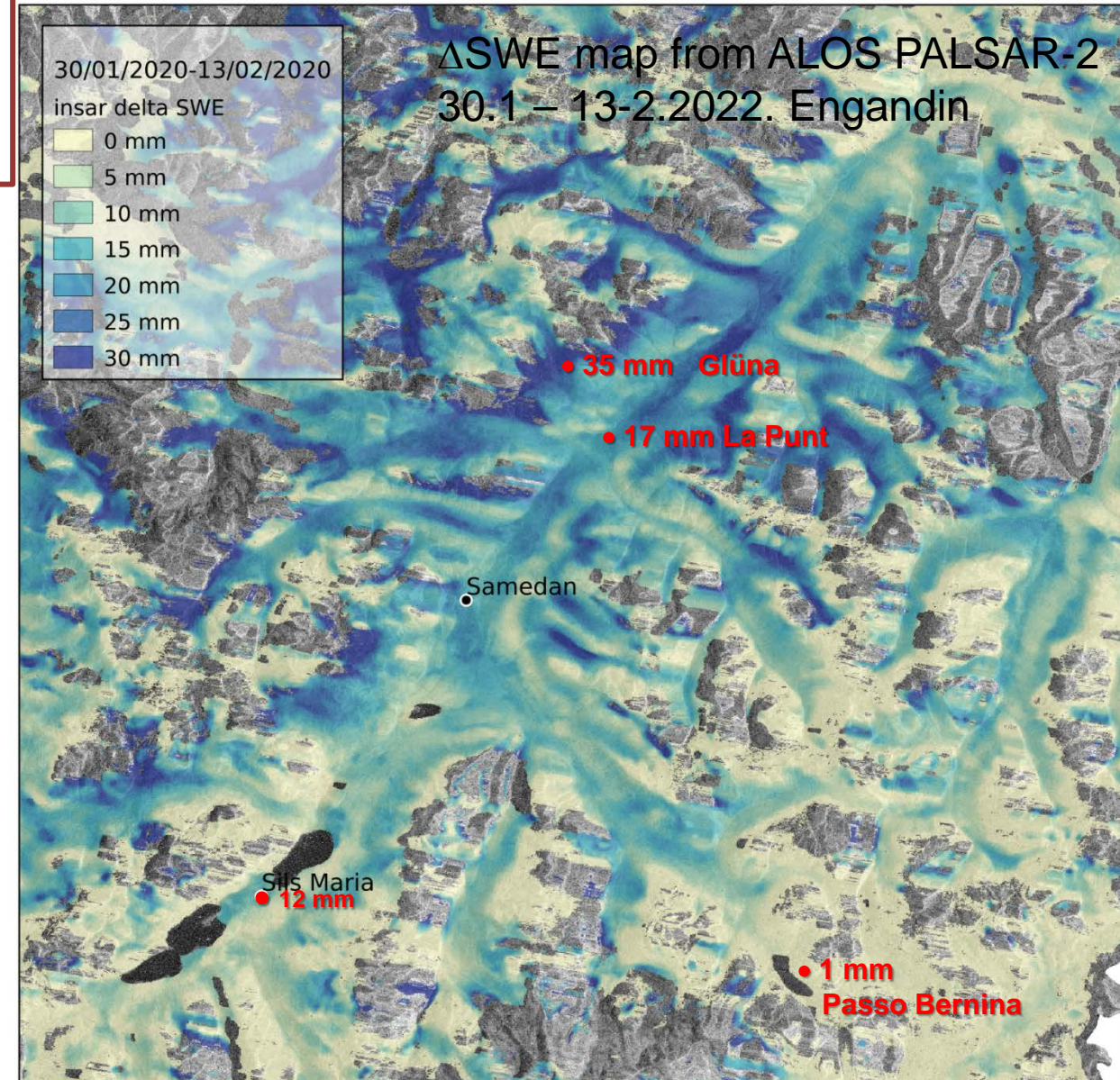
Developments in preparation for
Copernicus Radar Observing System for Europe
L-Band (ROSE-L) (launch planned for 2007)

Physical Basis / Rationale:

- Propagation of the SAR signal through **dry snow** causes of a **phase delay** $\Delta\phi_{snow}$ related to **SWE**

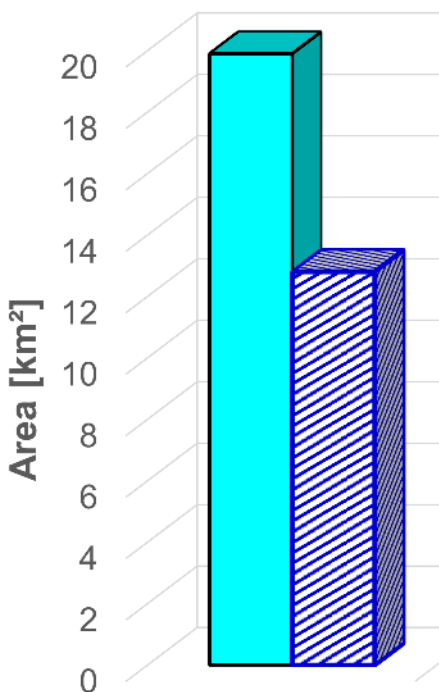


Airborne Field Campaigns for Algorithm
Development – Kühtai 2020 / ENVEO, DLR, ESA



Summer snow extent on glaciers as

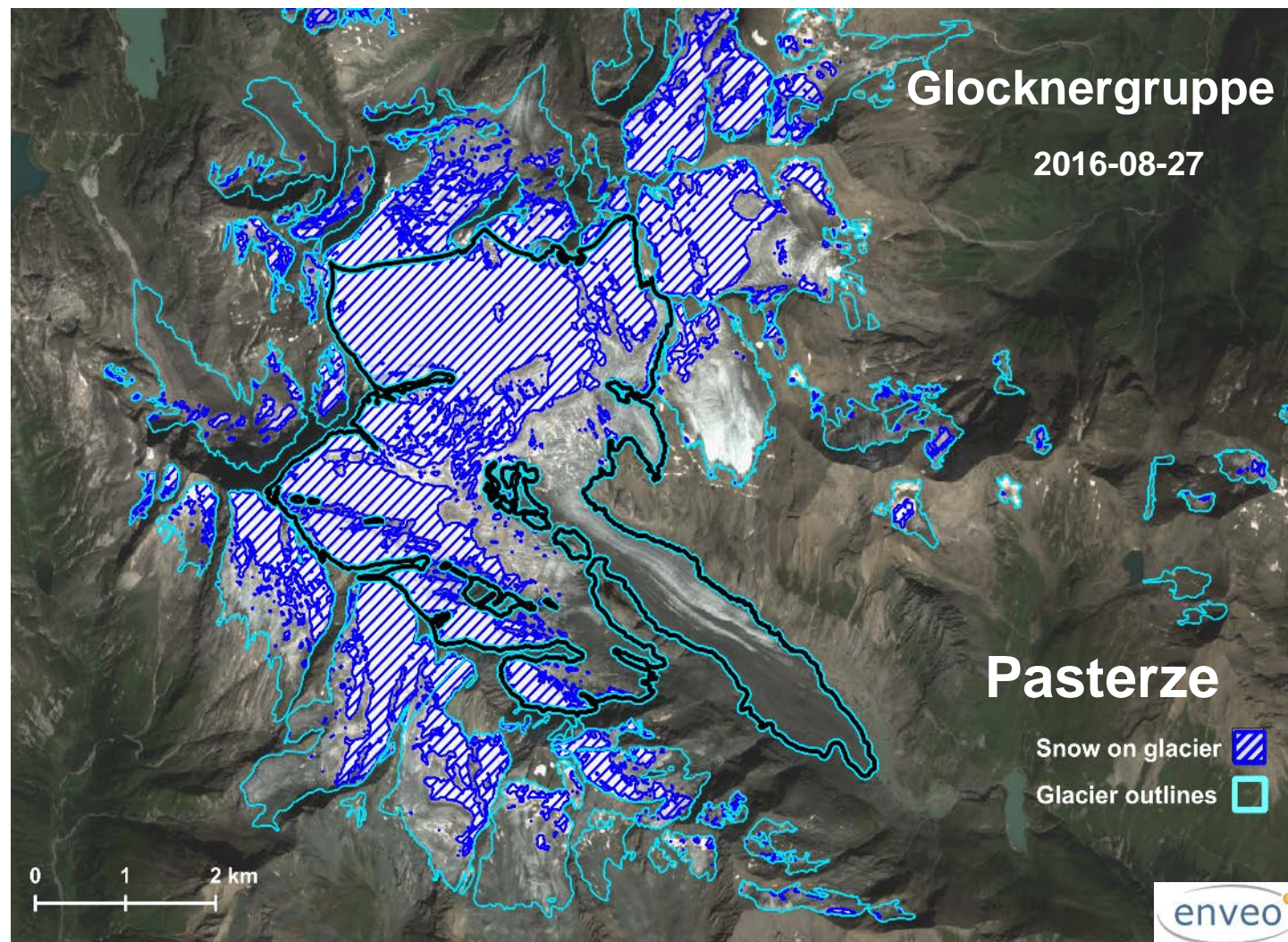
Late summer snow on Austria's largest glacier, Pasterze



1969 / 1985

■ Glacier area

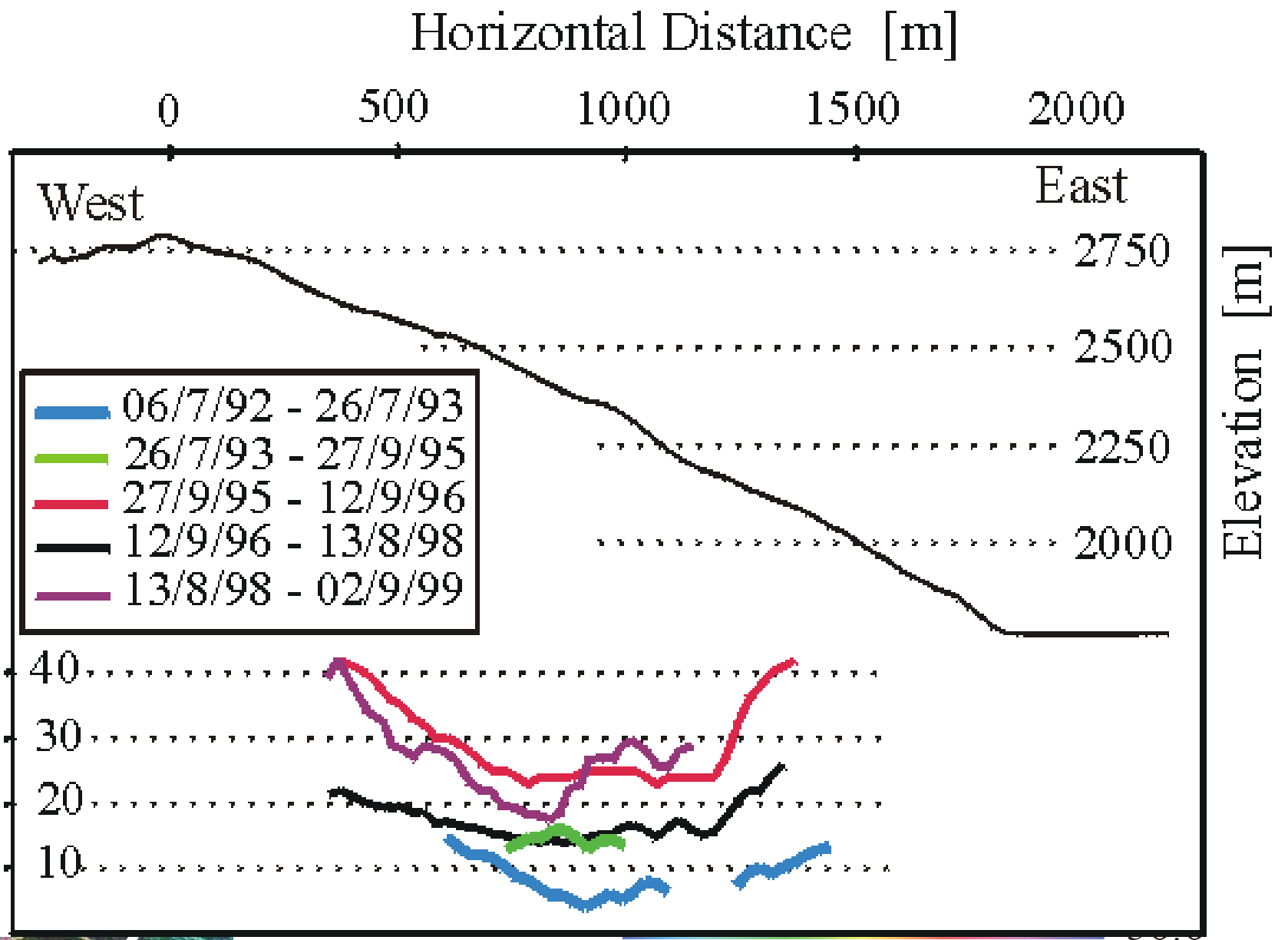
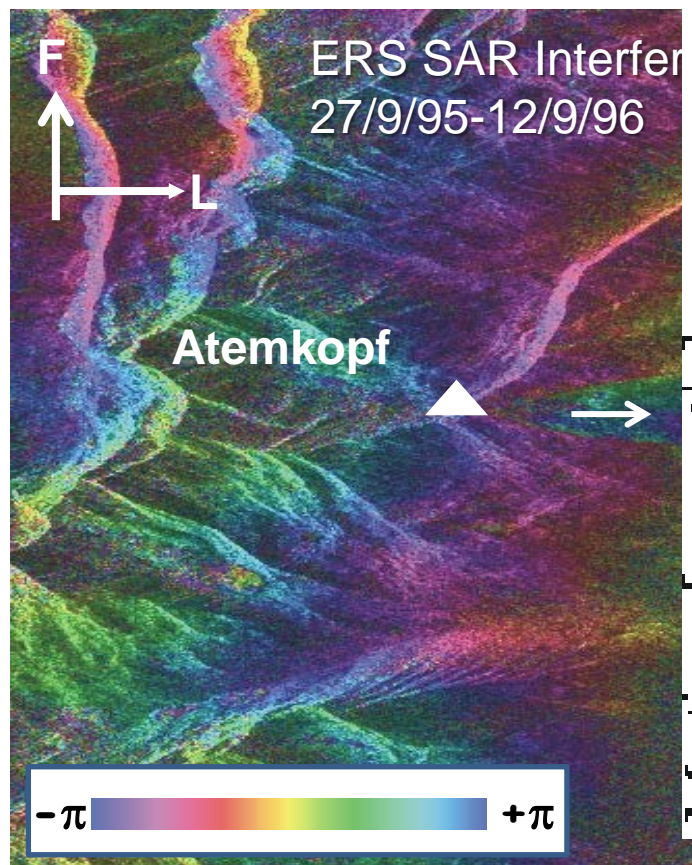
■ Snow area on glacier



Monitoring of slope movement by means of SAR Interferometry



Kaunertal
Gepatschtausee



Dr. Thomas Nagler
thomas.nagler@enveo.at

ENVEO IT GMBH
Innsbruck

