# Mapping glaciers with optical satellite data: Special Svalbard challenges

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esa

glaciers

Sentinel 2: Copernicus 2017

#### CONTENTS

Glaciers, sensors, spectral properties Glacier mapping with Sentinel 2 Special Svalbard challenges

# Typical cryosphere temporal / spatial scales







Gardner et al. (2013)



![](_page_5_Picture_0.jpeg)

### **Sensors: timelines and applications**

![](_page_6_Figure_1.jpeg)

Paul (Glaciers\_cci)

# Spectral bands and atmospheric transmission

![](_page_7_Picture_1.jpeg)

![](_page_7_Figure_2.jpeg)

Courtesy: A. Kääb

#### Spectral properties of ice and snow

![](_page_8_Picture_1.jpeg)

# Spatial resolution: Landsat 8 OLI (30 m)

![](_page_9_Picture_1.jpeg)

![](_page_9_Picture_2.jpeg)

## Spatial resolution: Sentinel 2 MSI (10 m)

![](_page_10_Picture_1.jpeg)

![](_page_10_Picture_2.jpeg)

# MSI false colour composite

![](_page_11_Picture_1.jpeg)

![](_page_12_Picture_0.jpeg)

![](_page_13_Picture_0.jpeg)

![](_page_14_Picture_0.jpeg)

![](_page_15_Picture_0.jpeg)

![](_page_16_Picture_0.jpeg)

![](_page_17_Picture_0.jpeg)

# Outlines from ratio 6 and 5x5 noise filter

![](_page_18_Picture_1.jpeg)

![](_page_19_Picture_0.jpeg)

![](_page_20_Picture_0.jpeg)

## Summary

![](_page_21_Picture_1.jpeg)

- Glacier mapping with a simple red/SWIR band ratio is straight forward, but a blue band threshold is required for shadow
- General glacier mapping challenges
  - debris cover, clouds, shadow, seasonal snow
- Special Svalbard challenges
  - frequent clouds and seasonal snow (maritime climate)
  - very dark ice (not mapped), turbid water and sea ice / ice bergs (wrongly mapped)
- Compared to the RGI (after debris correction), raw extents are larger as perennial lateral snow patches are included
  - This is a principal decision, that has been handled differently in inventories
- There is considerable retreat for most Svalbard glaciers but several also advanced (surge-type)