36 YEARS OF DAILY SNOW COVER DATA FOR EUROPE BASED ON AVHRR DATA: RESULTS FROM THE DLR TIMELINE PROJECT

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AIMS AND OBJECTIVES

TIMELINE: Time Series Processing of Medium Resolution Earth Observation Data assessing Long -Term Dynamics In our Natural Environment

- Generation of a homogenous multi-decadal time series
- Development of a comprehensive range of remote sensing land and atmosphere products
- Enable change detection analyses
- Identify geophysical phenomena and trends in Europe
- Answer climate-relevant research questions

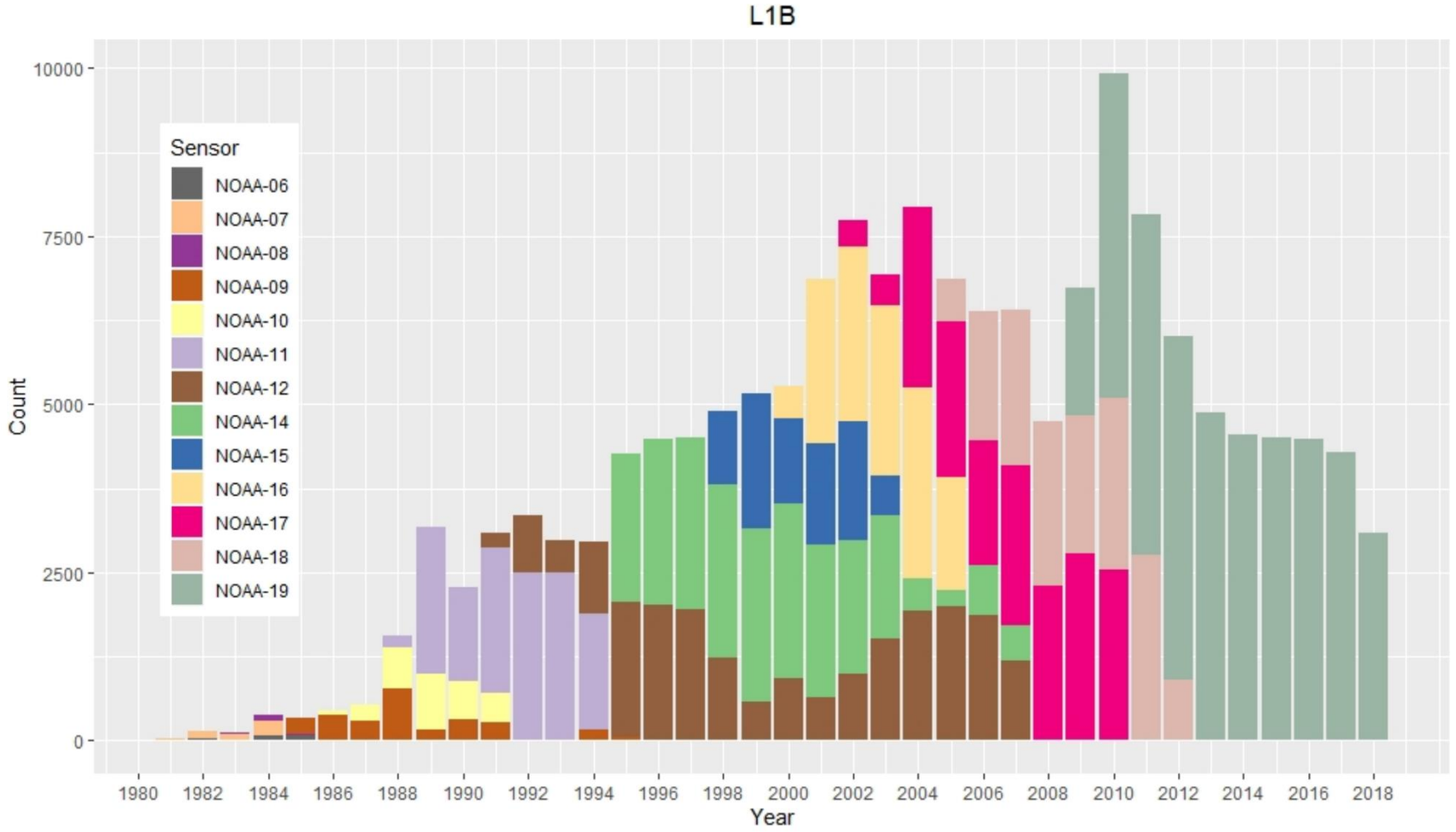
https://www.standard.co.uk/news/world/portugal-wildfires-fivestar-resort-evacuated-as-blaze-rages-on-in-wake-of-46c-heatwave-a3904486.html

http://earth-chronicles.com/wp-content/uploads/2017/04/PEgwnhh2f9s.jpg

https://weather.com/news/news/2018-08-02-drought-crop-failures-europe-farmers

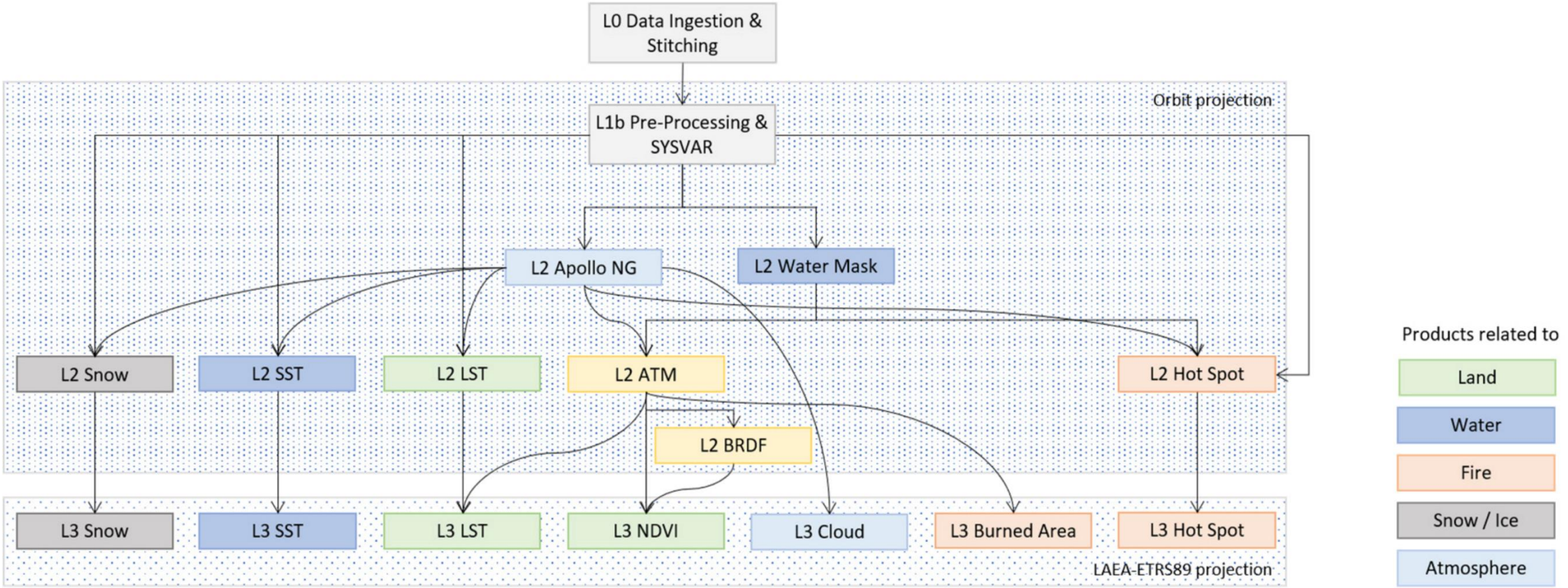
AVHRR DATA BASE

AVHRR DATA REPOSITORY

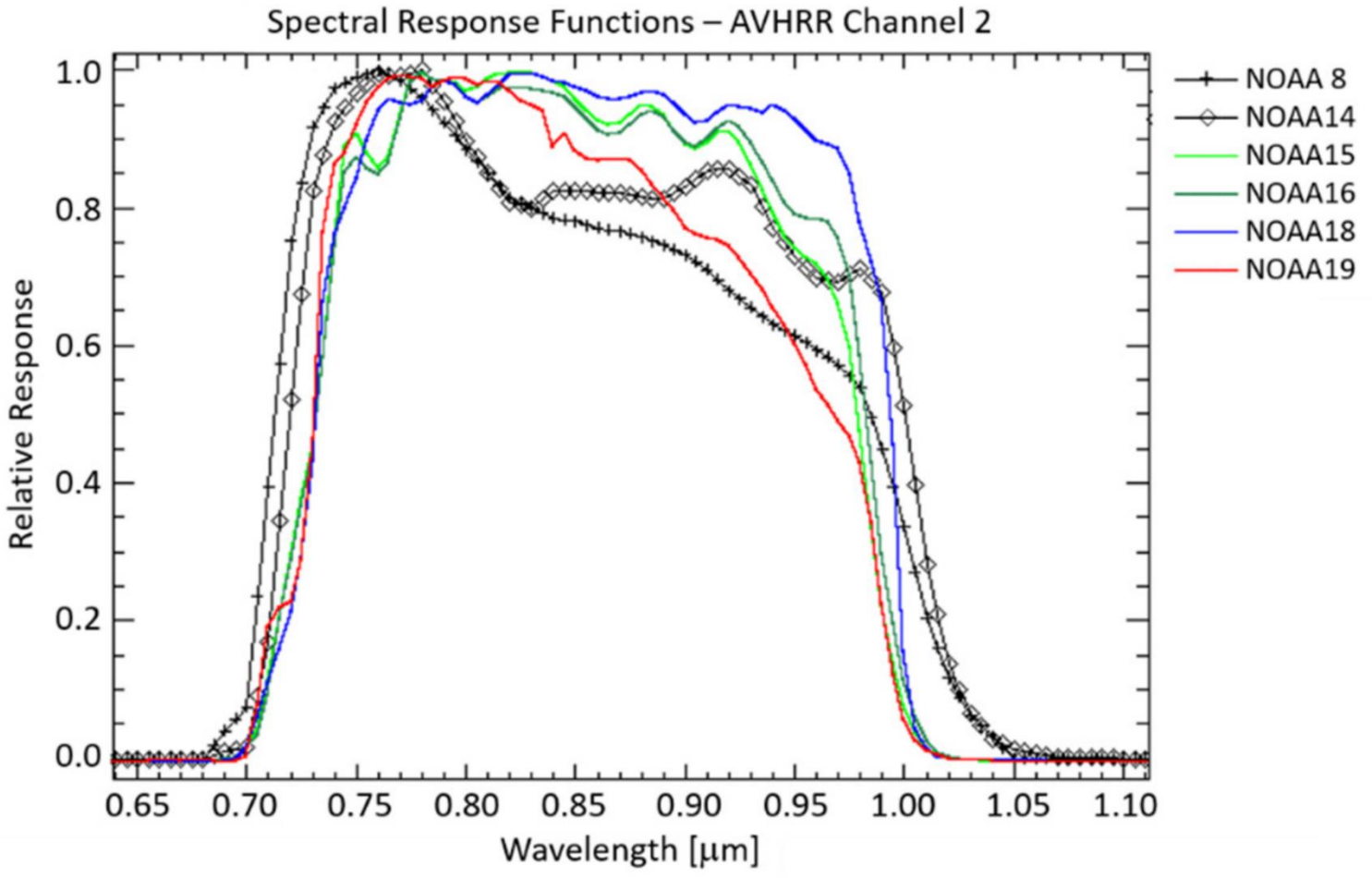


- isolated data available since October 1981
- almost **160 000** scenes in total
- Snow Cover Processor needs thermal information (AVHRR/1 not useable)

WORKFLOW AND PRODUCT SUITE



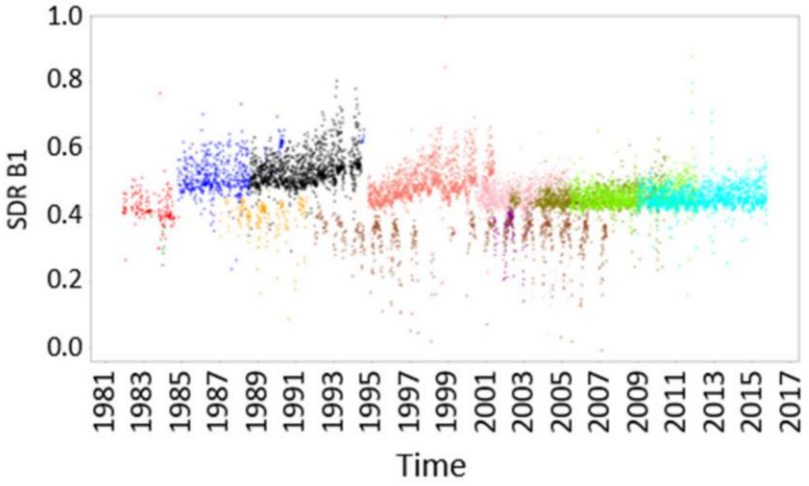
HARMONIZATION

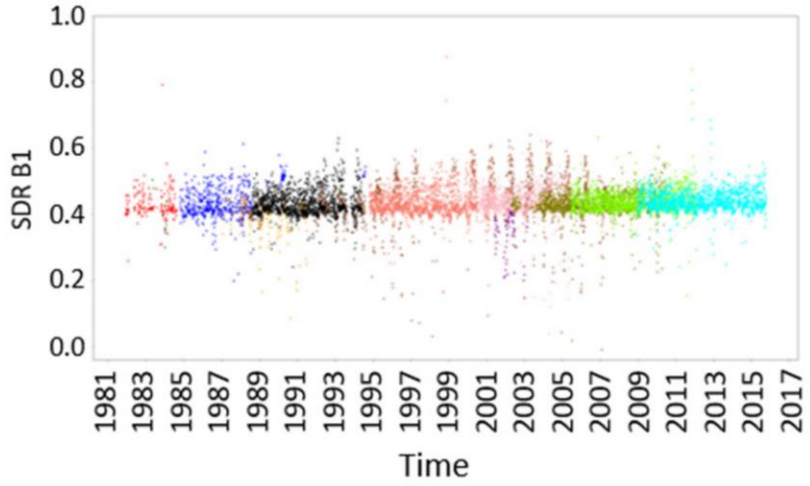


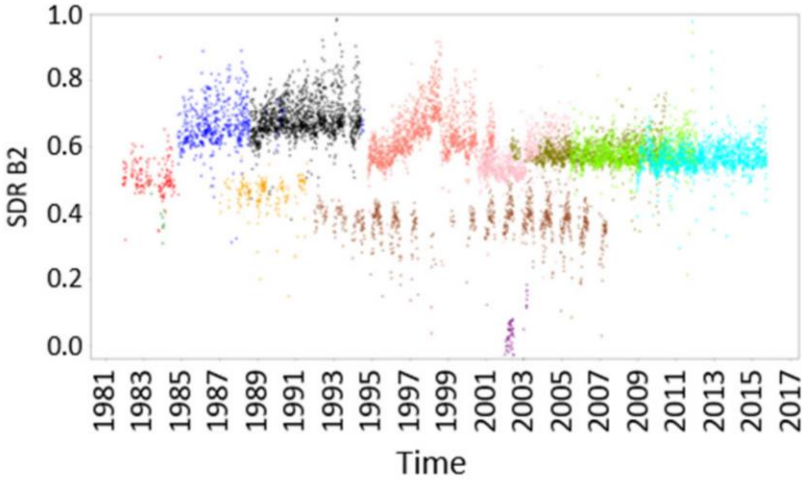
- spectral response functions are slightly different for each individual AVHRR instrument
- Channel 2 for six platforms as example
- They were also reported to have changed in orbit

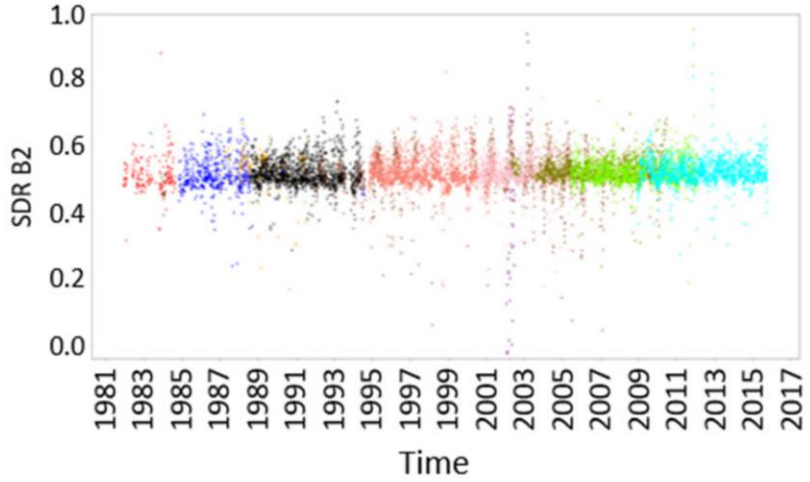
→ Ongoing harmonization needed

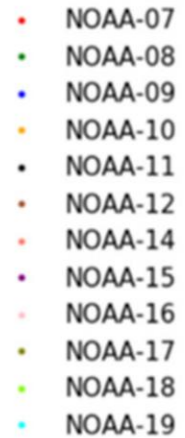
HARMONIZATION







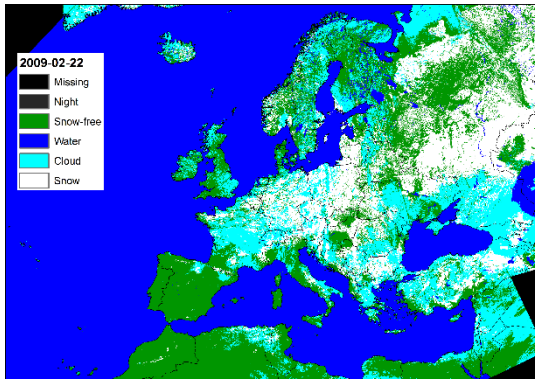




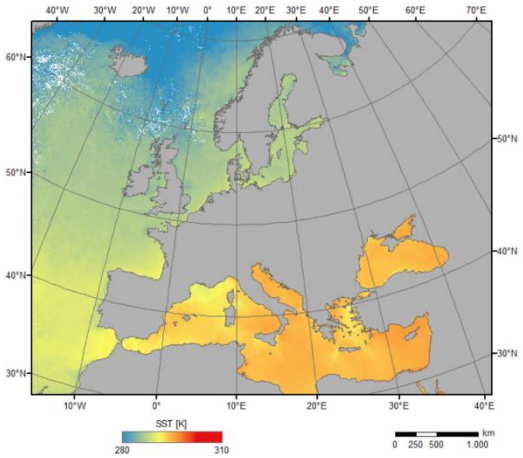
- radiometric harmonization of the SDR (surface directional reflectance) time series
- based on pseudo-invariant calibration sites (PICS)
- Bright sites (desert) for low gain mode
- dark sites (dark and dense forests) for high gain mode

L3 PRODUCTS

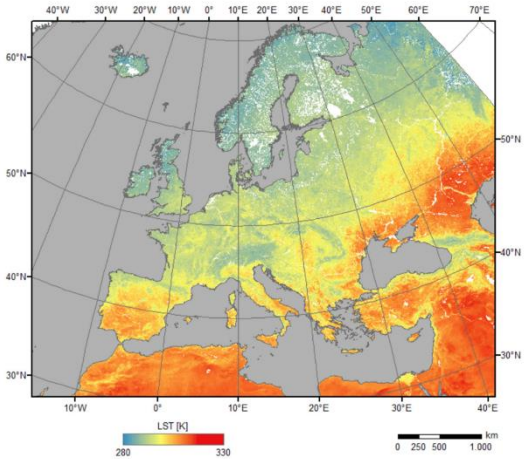
L3 Snow



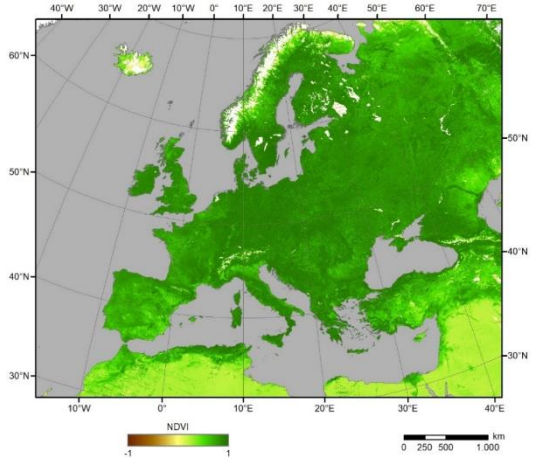
L3 SST



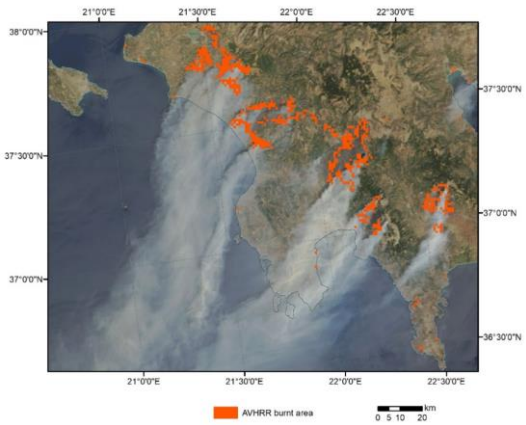
L3 LST



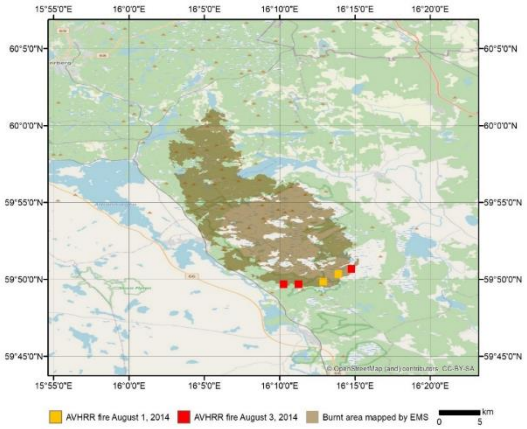
L3 NDVI



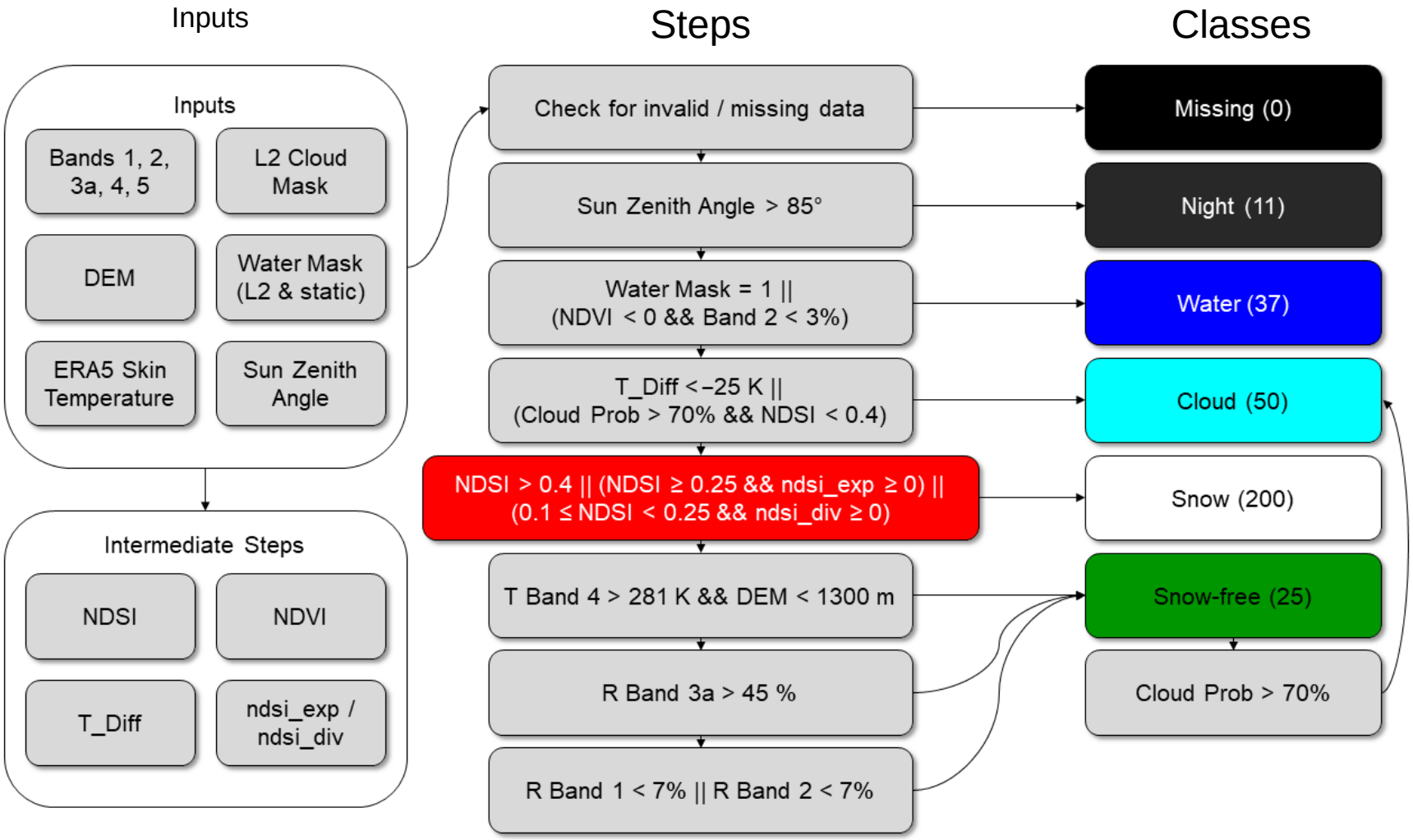
L3 Burnt Area



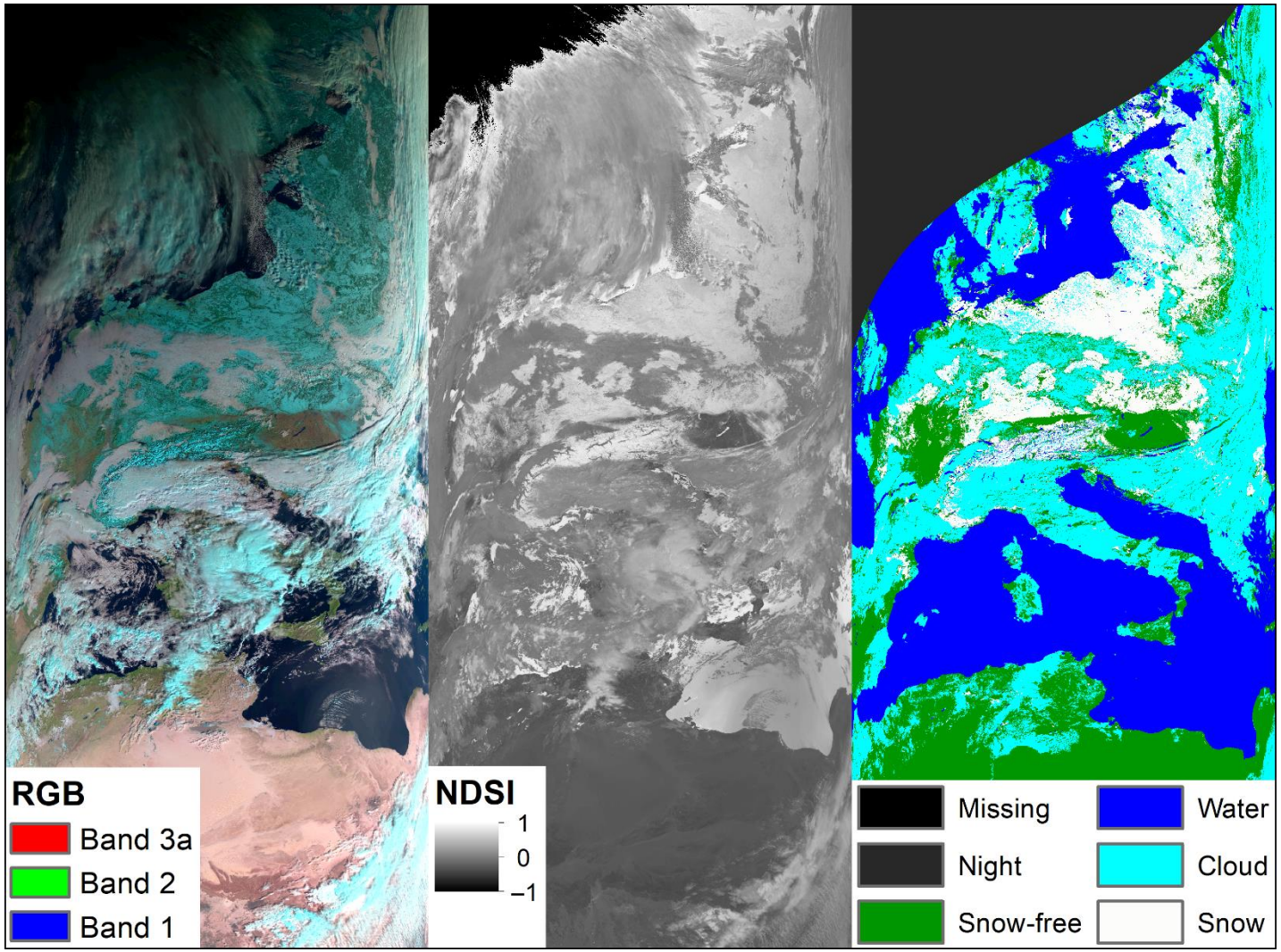
L3 Hot Spot



L2 SNOW COVER PROCESSOR



L2 SNOW COVER EXAMPLE

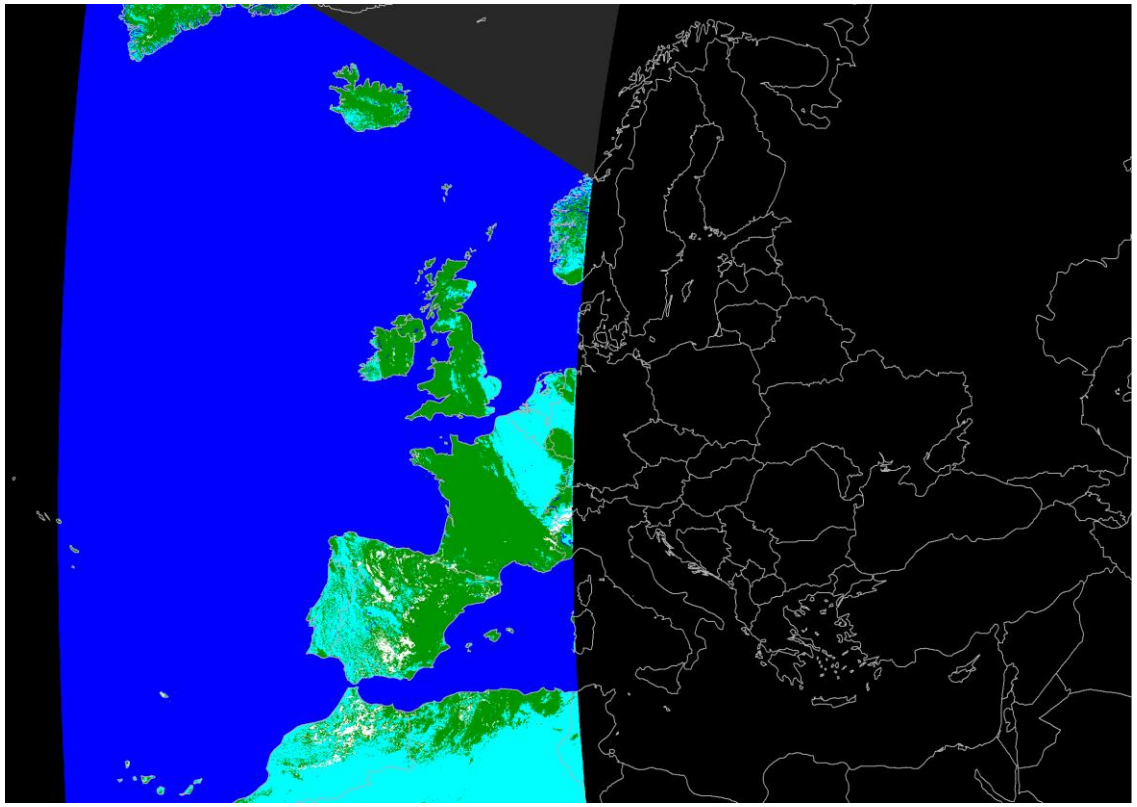


- Snow in RGB appears cyan (low reflection in red channel)
- Snow-free land has lowest NDSI, snow and water have high NDSI

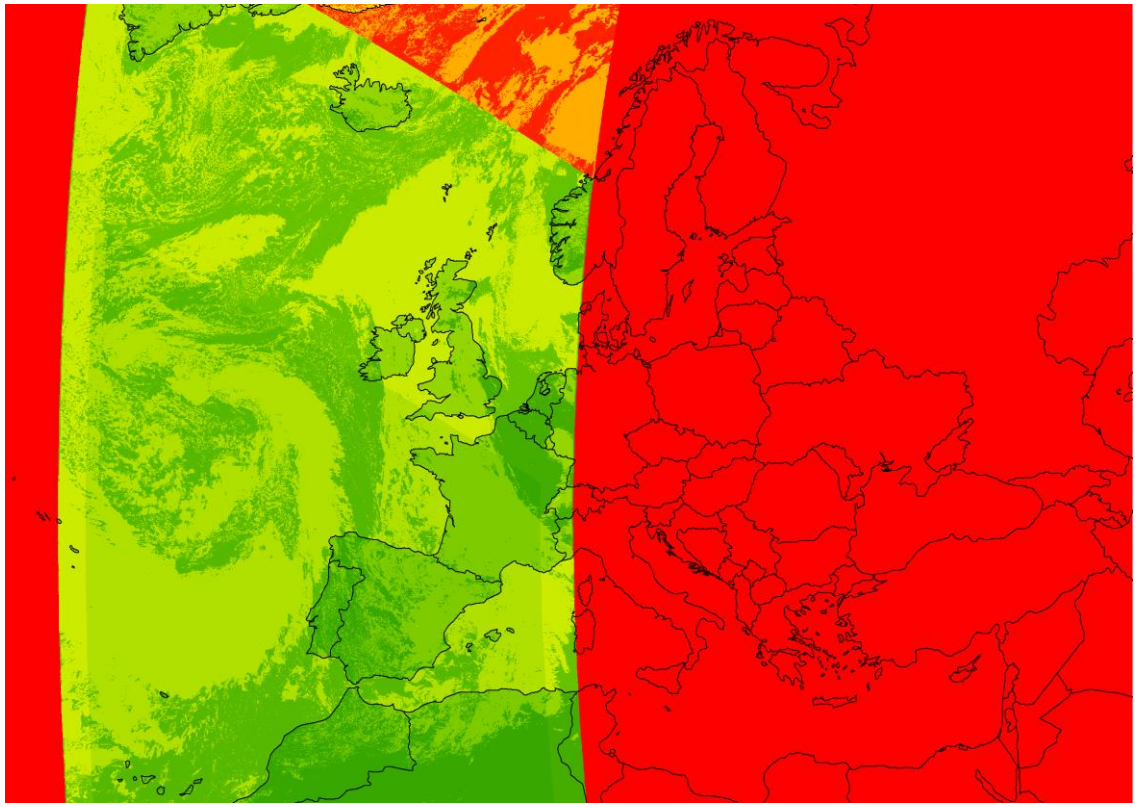
  →Additional thresholds
- Clouds have intermediate or high NDSI

→ Application of cloud mask and difference in skin temperature

L3 SNOW COVER – DAILY COMBINATION

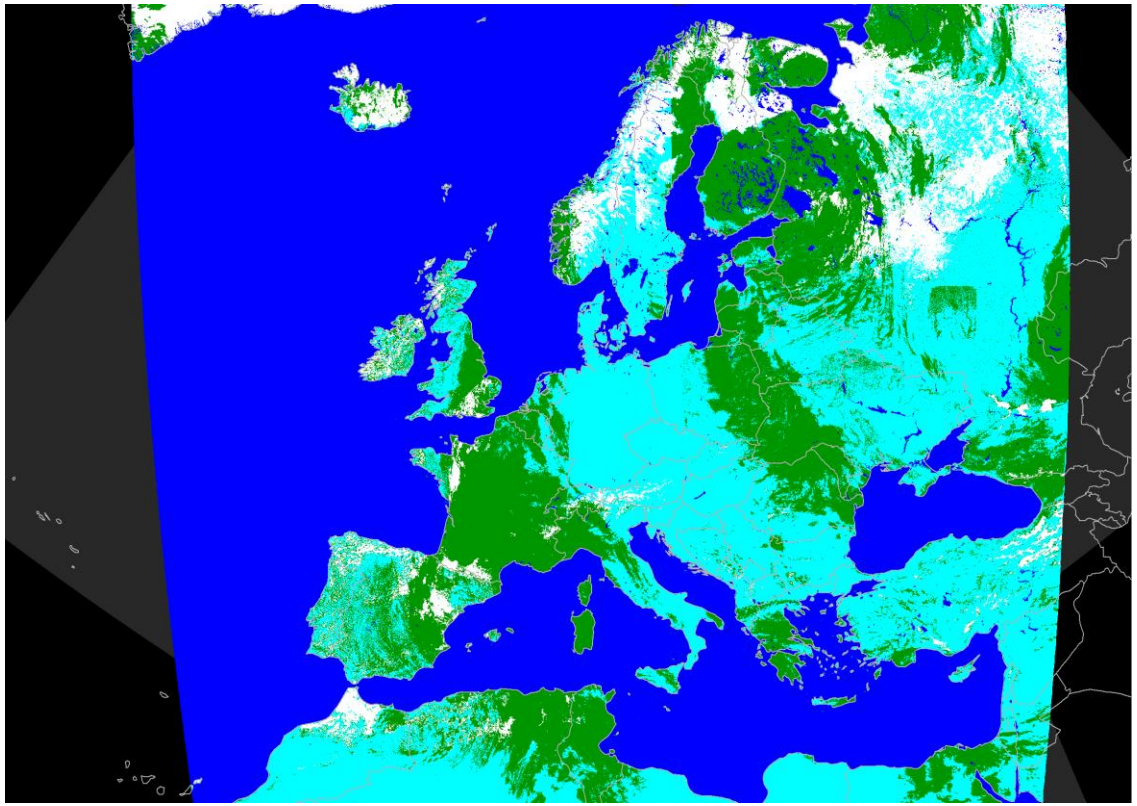


Scene from 01/31/2009 in LAEA-ETRS89 projection

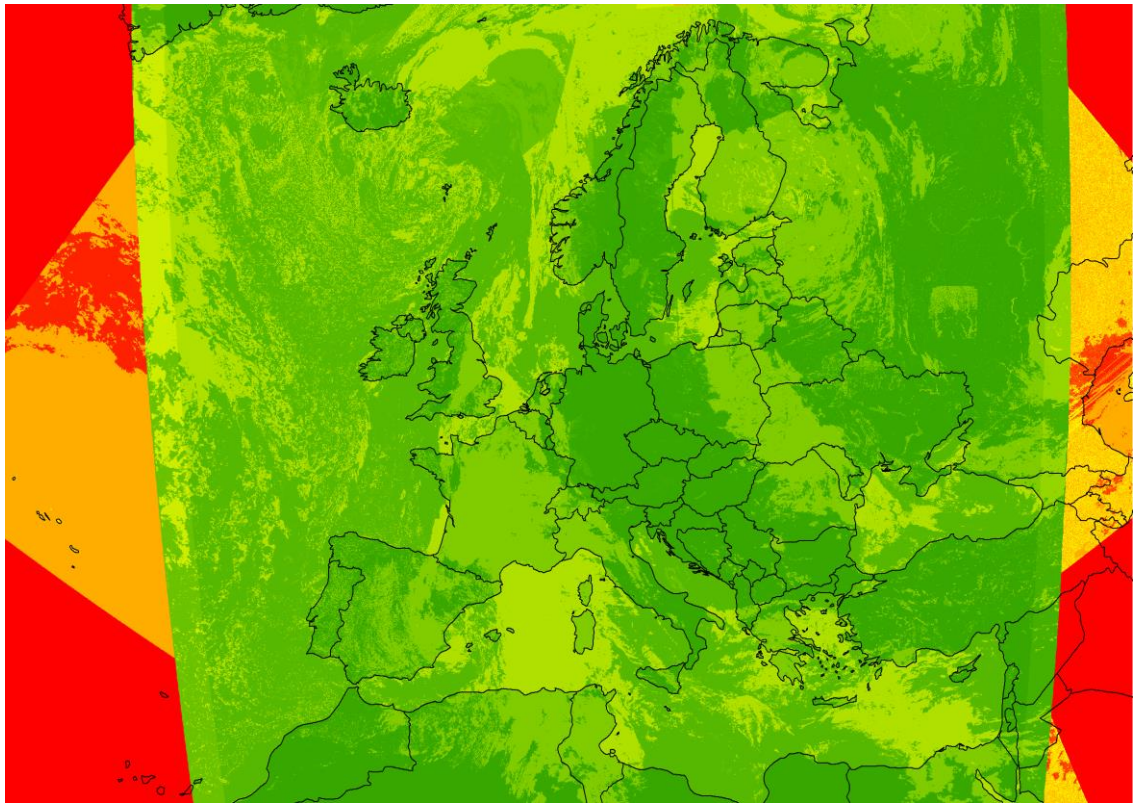


Quality layer of the scene from 01/31/2009

L3 SNOW COVER – DAILY COMPOSITE

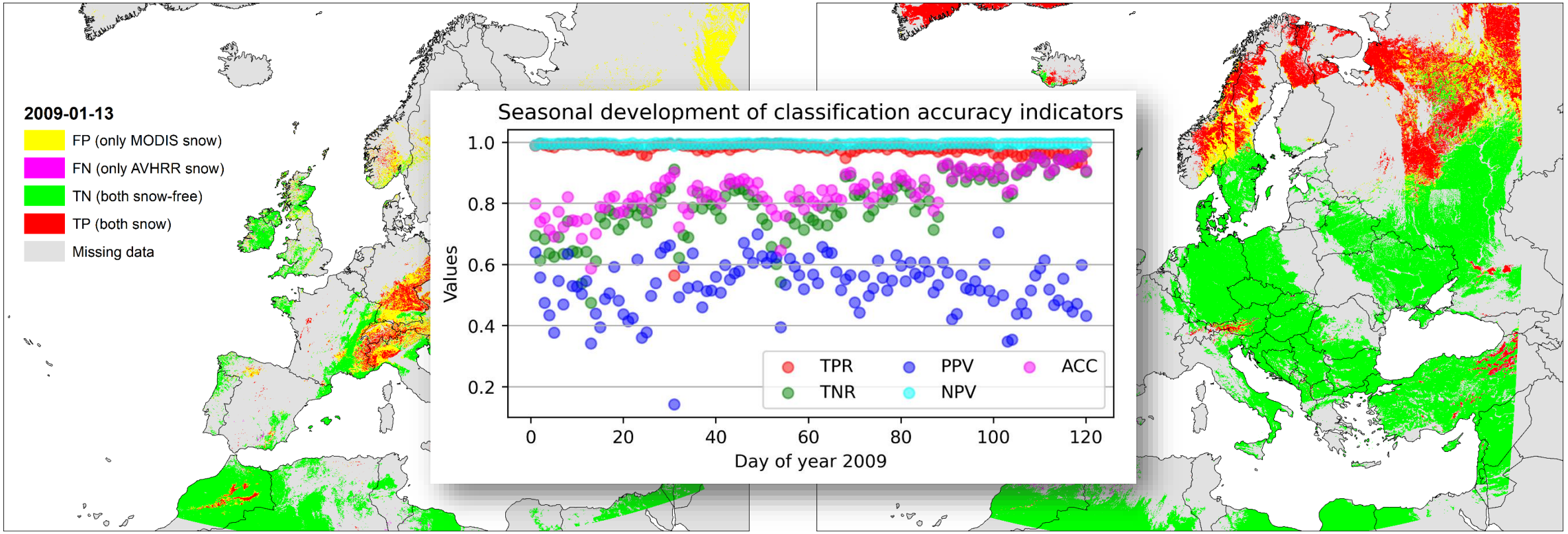


Daily composite as of 04/11/2009, pixel selection based on lowest (best) quality layer value



Daily quality layer composite from 04/11/2009

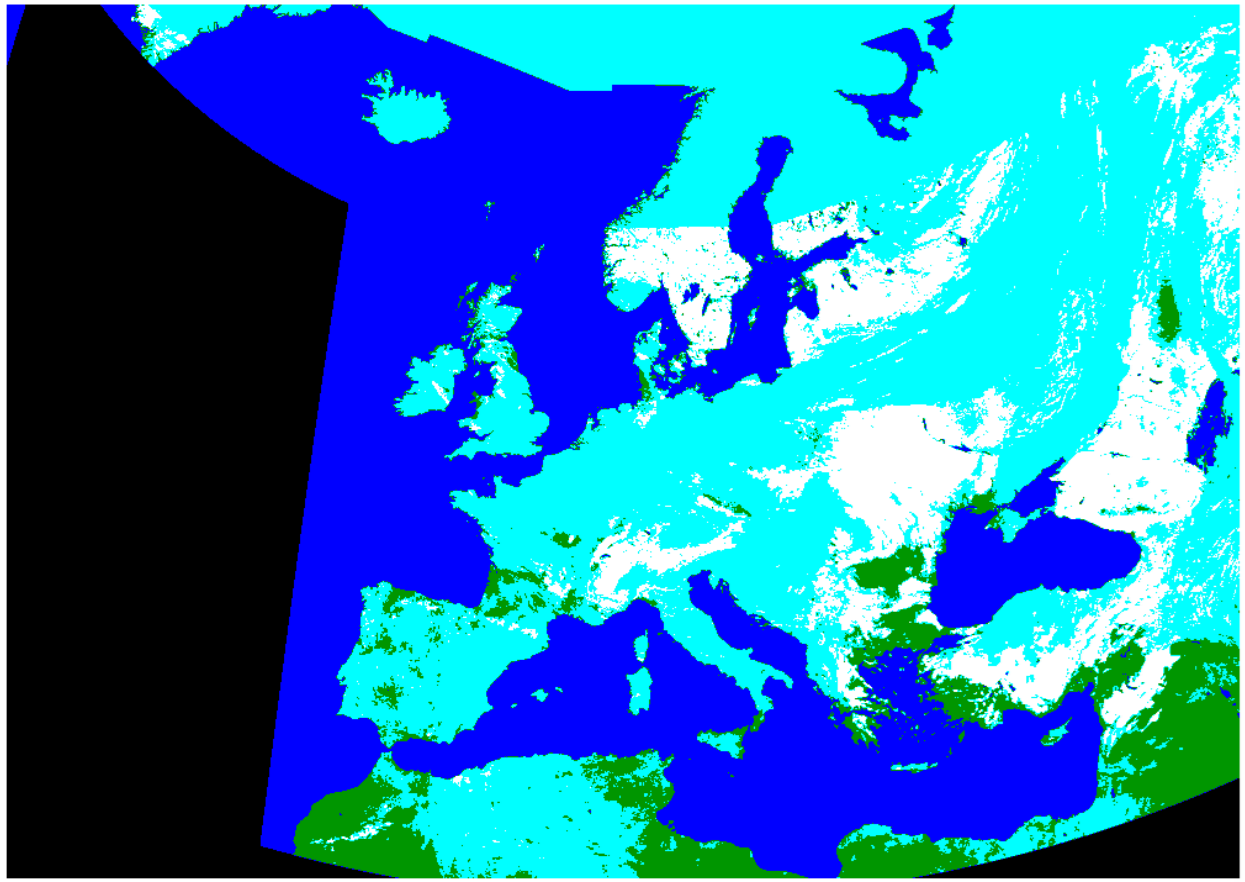
L3 SNOW COVER PRODUCT VALIDATION



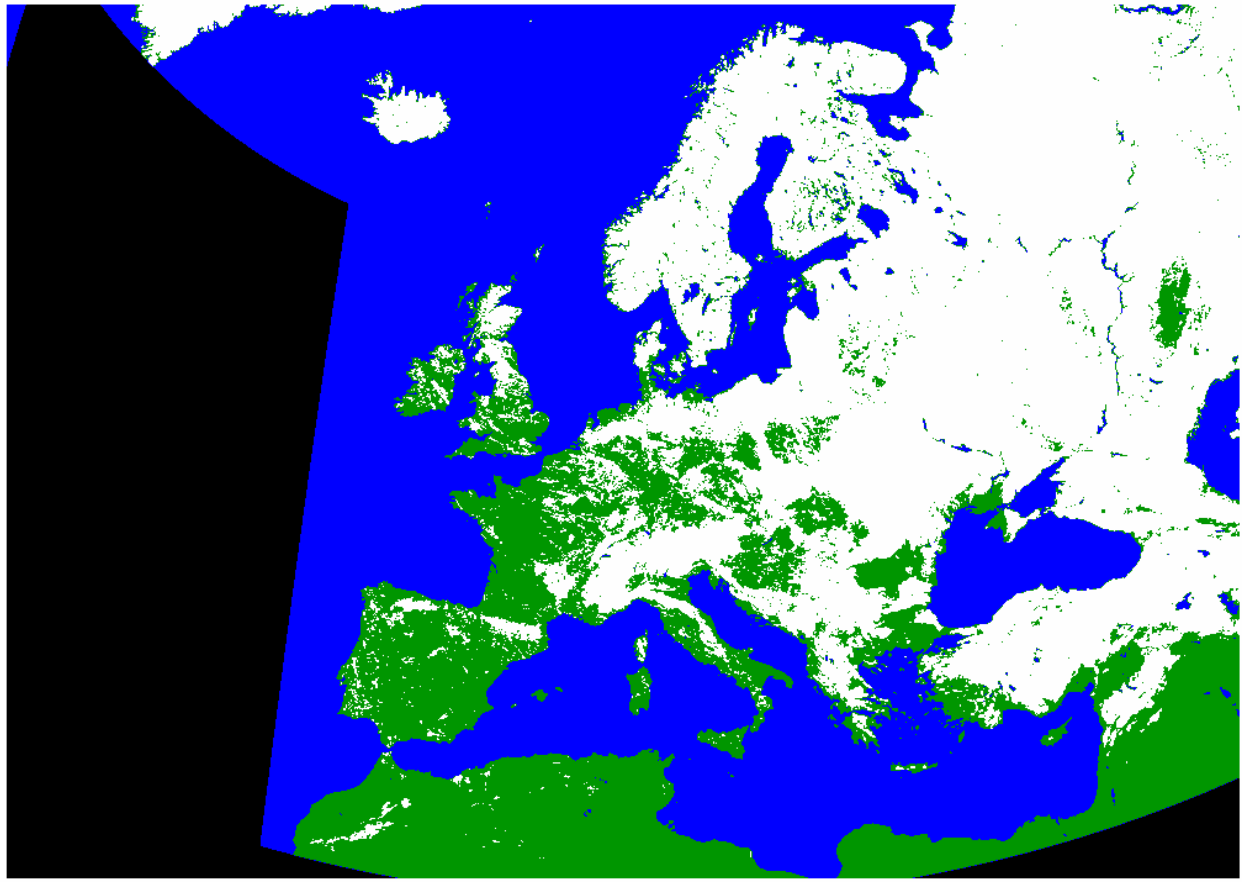
		MODIS	
		Snow	**Snow-Free**
AVHRR	**Snow**	TP (true positive)	FP (false positive)
	Snow-free	FN (false negative)	TN (true negative)

L3 SNOW COVER FILLING GAPS

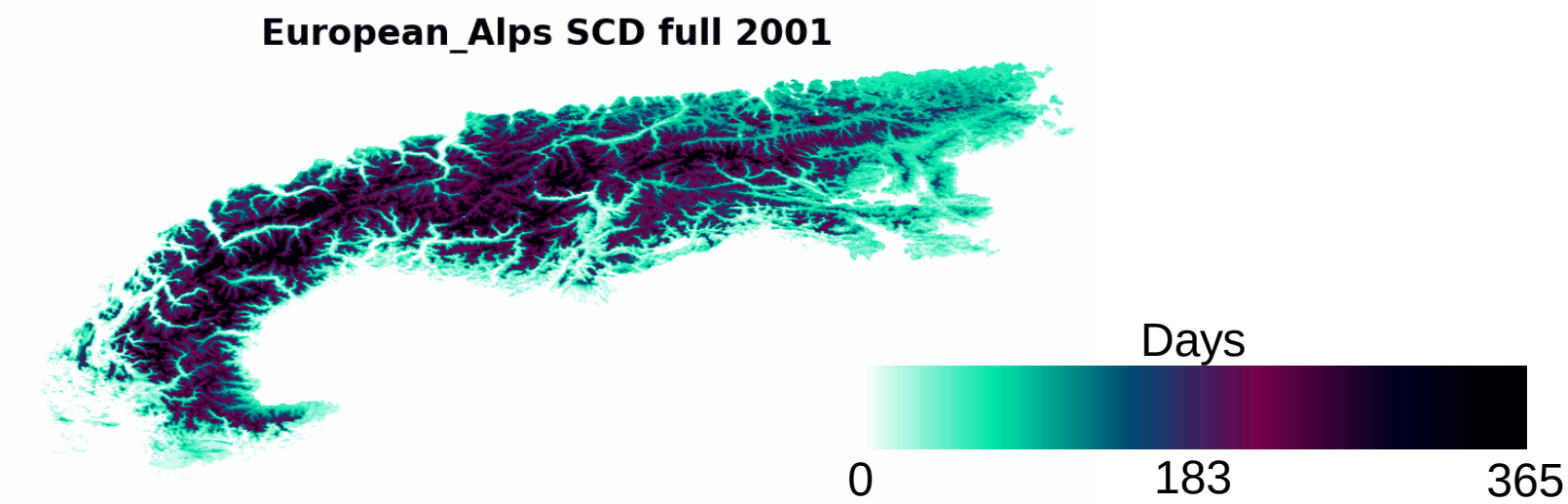
2009-01-01

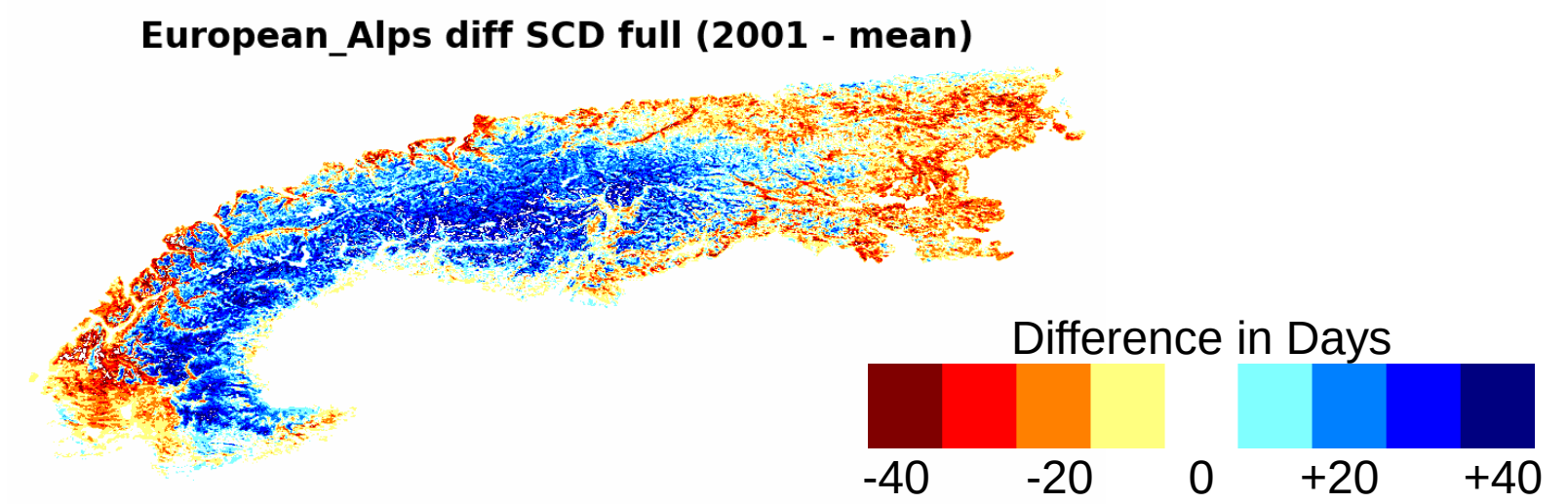


2009-01-01



L3 SNOW COVER POSSIBLE APPLICATIONS





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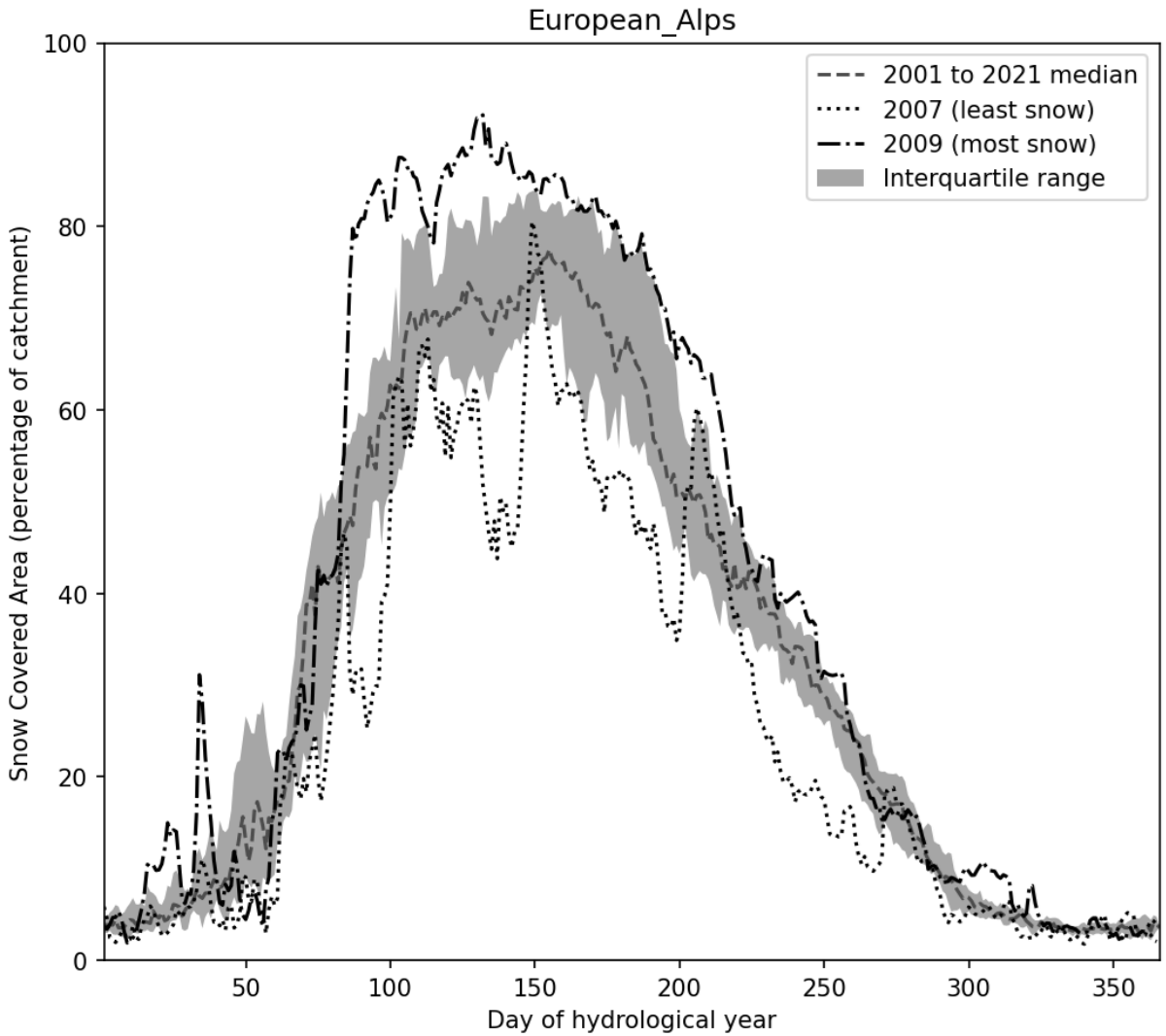
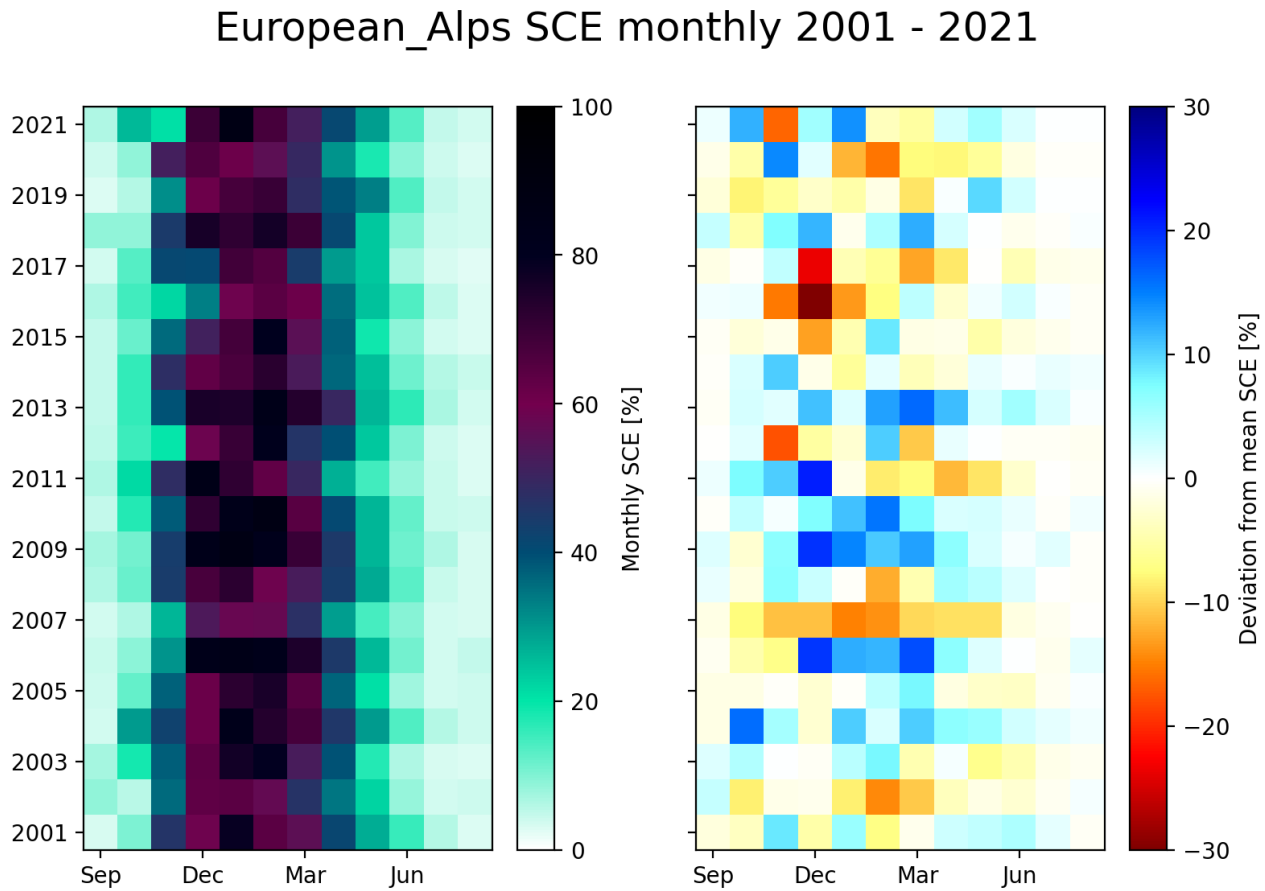
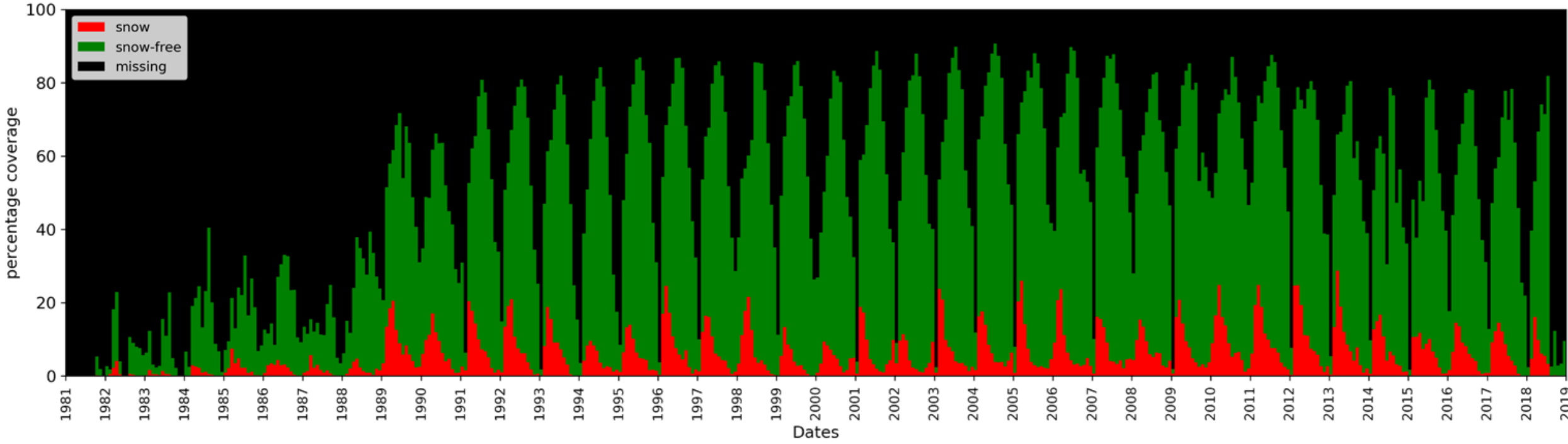




The TIMELINE time series will enable identification of trends and developments

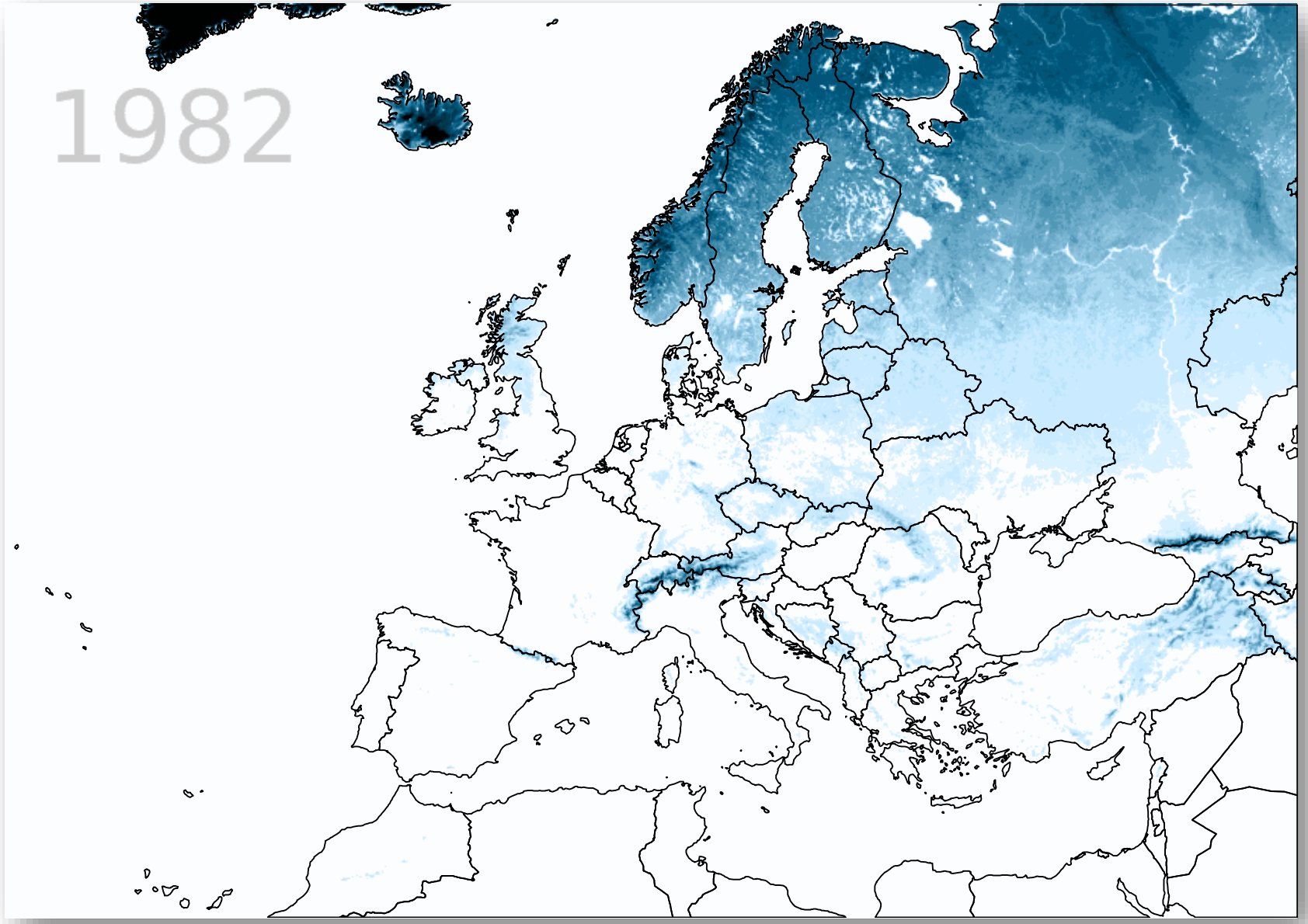
Snow cover information included in the data



Data gaps in winter due to extensive cloud cover and the effect of polar darkness on the higher latitudes

Generally lower data availability in the early to late 1980s

Snow Cover Duration: Early season (1982-2018)

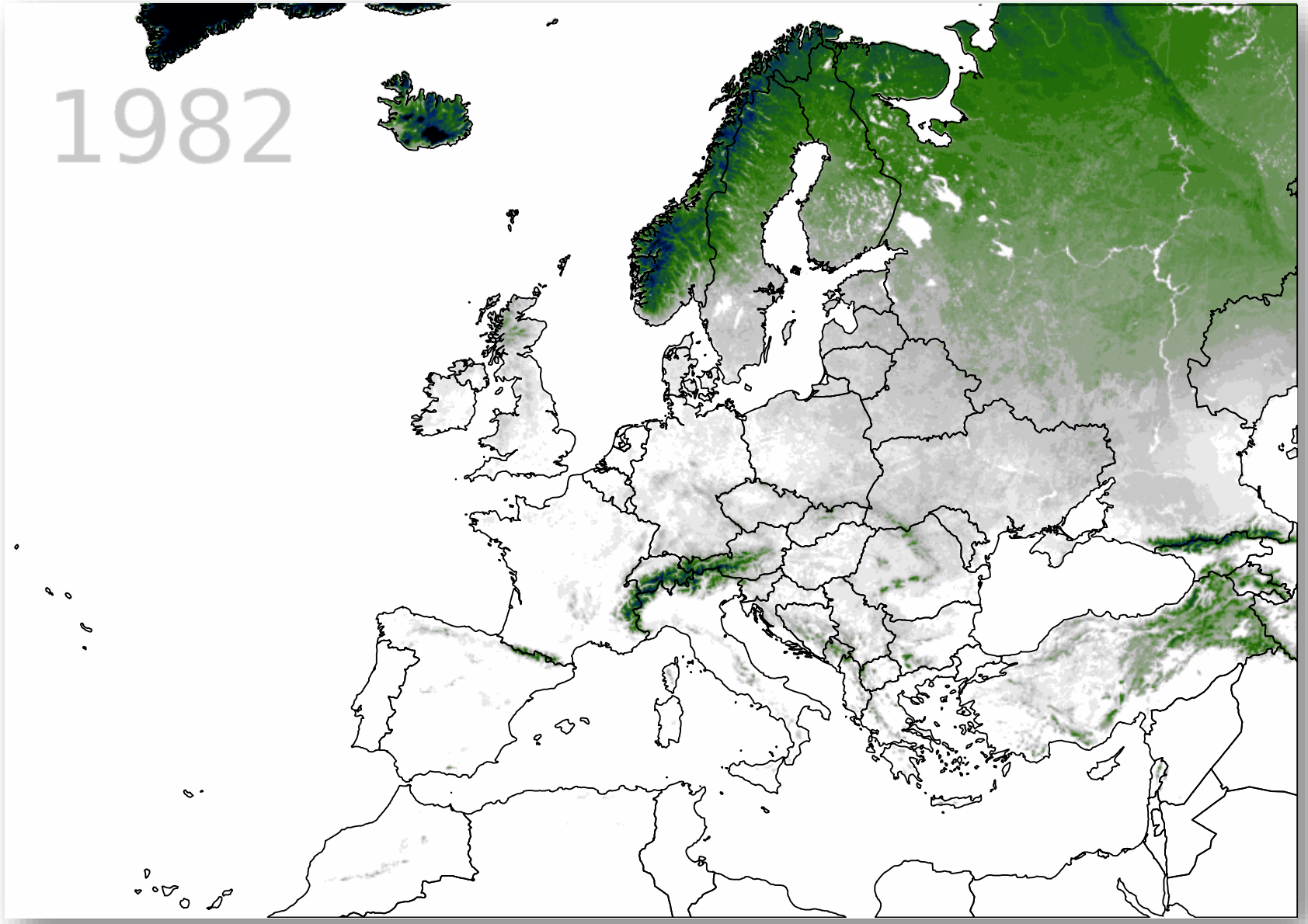


Early season starts on September 1st and ends on January 15th.

Early SCD in Days

0 68 136

Snow Cover Duration: Late season (1982-2018)

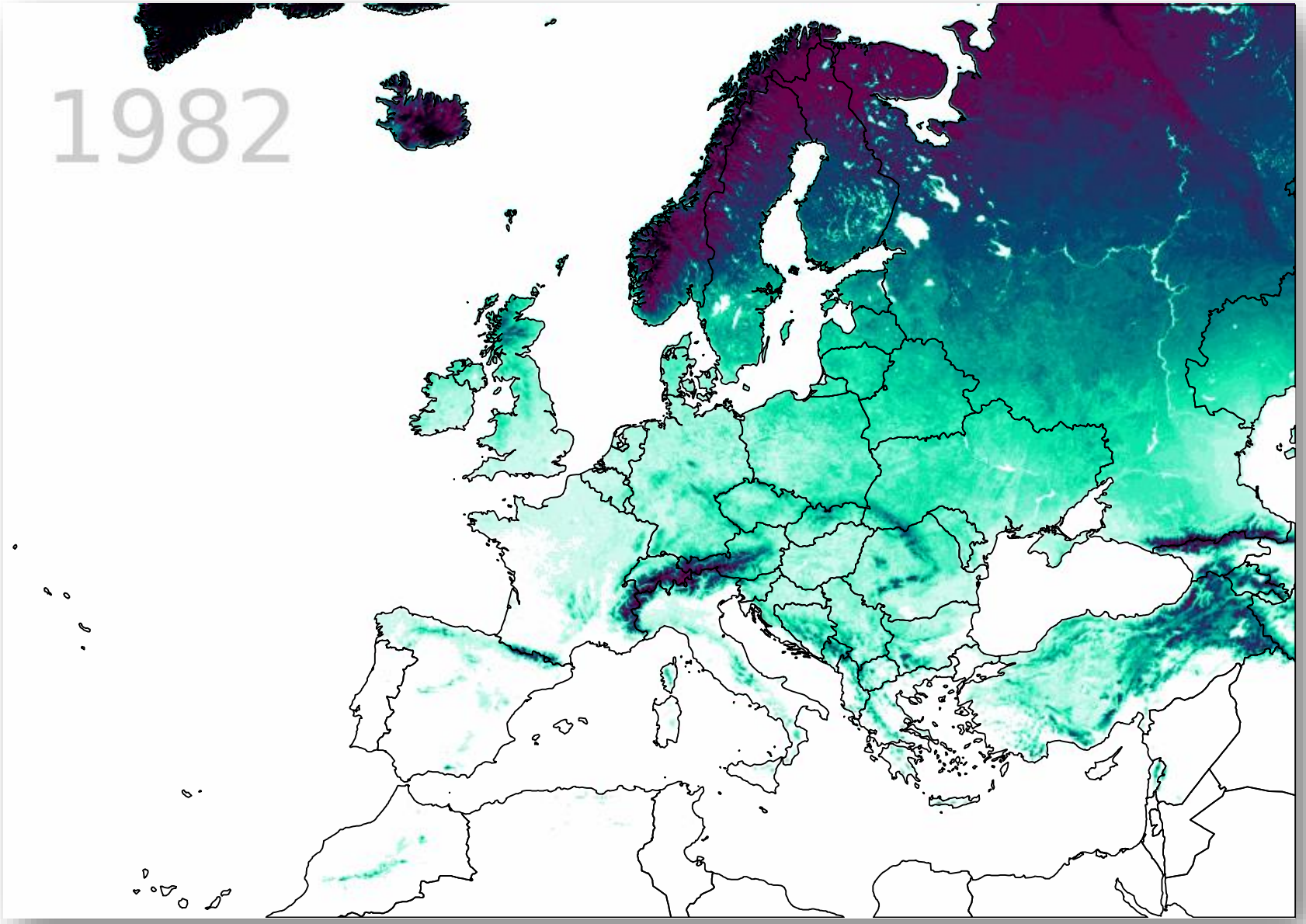


Late season starts on January 16th and ends on August 31th.

Late SCD in Days

0 114/115 229/230

Snow Cover Duration: Full season (1982-2018)

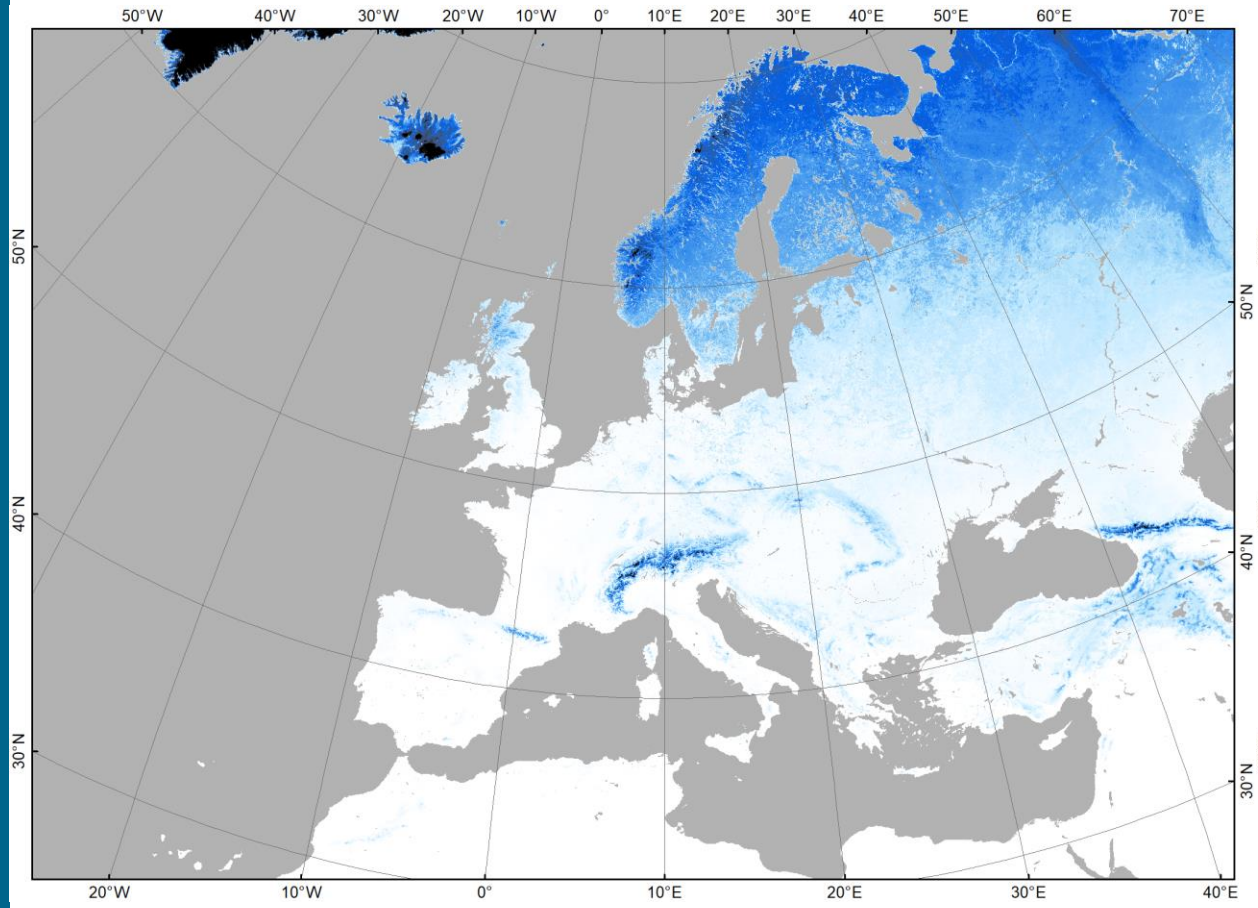


Full season starts on September 1st and ends on August 31th.

Full SCD in Days

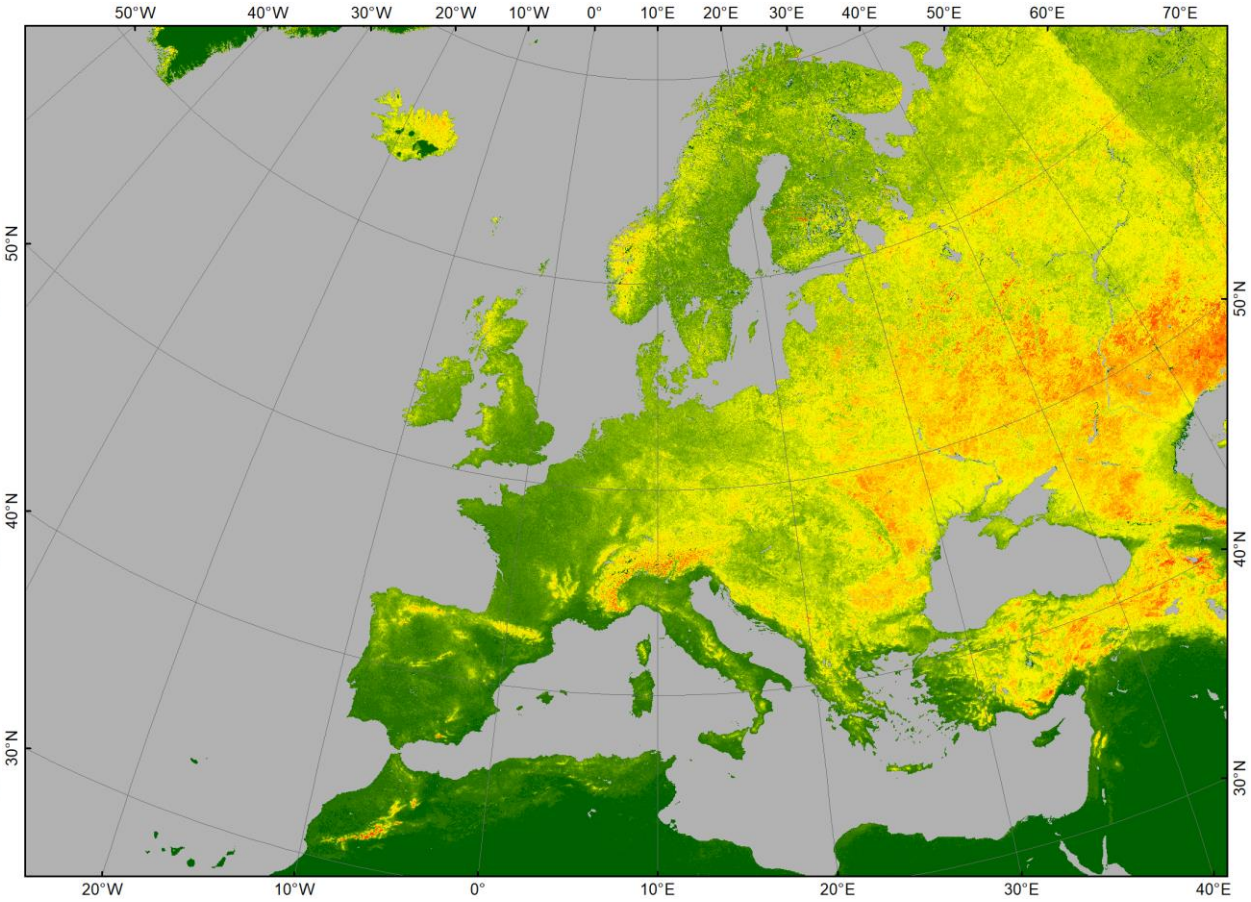
0 182/183 365/366

Early Snow Cover Duration: Mean & SD (1982-2018)



Early SCD in Days

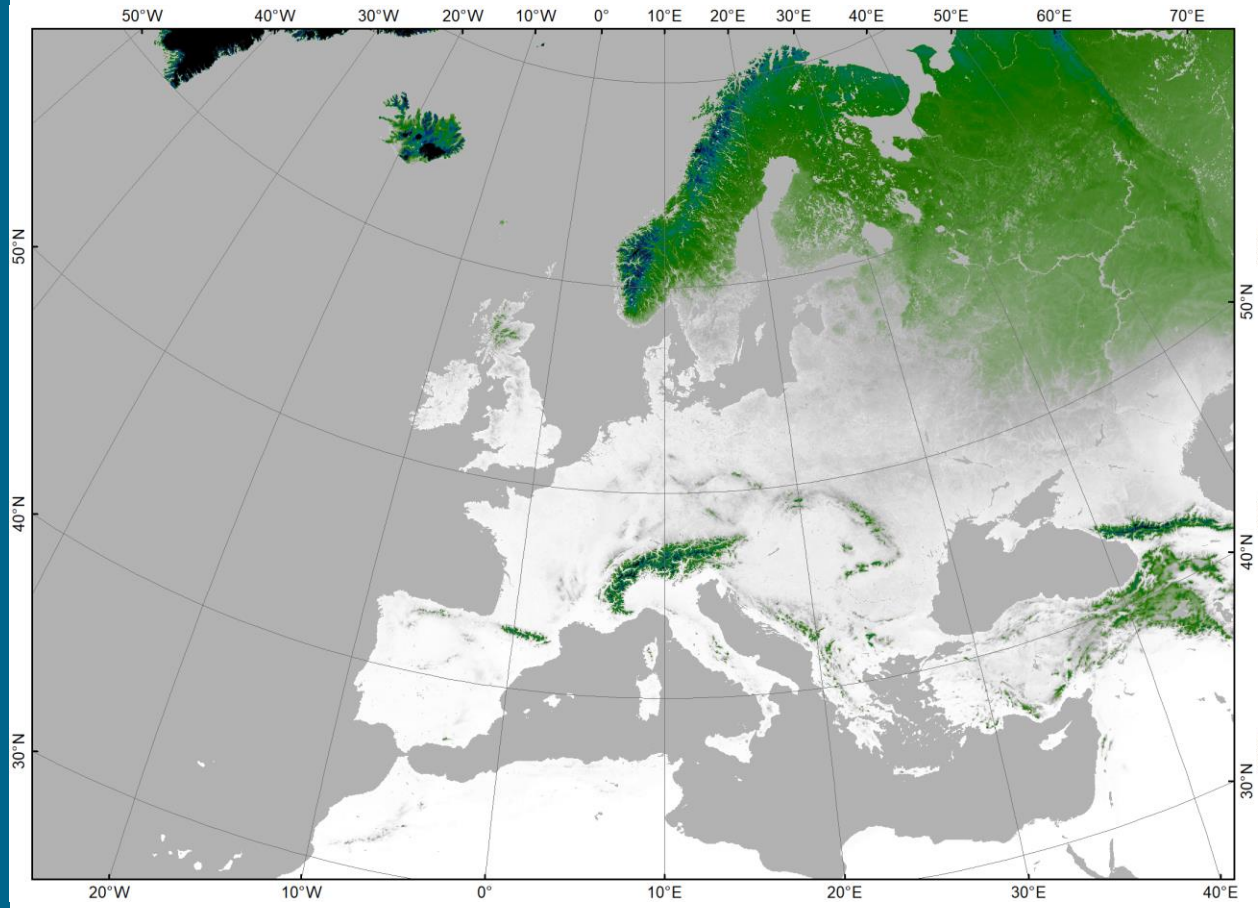
0 68 136



Standard Deviation in Days

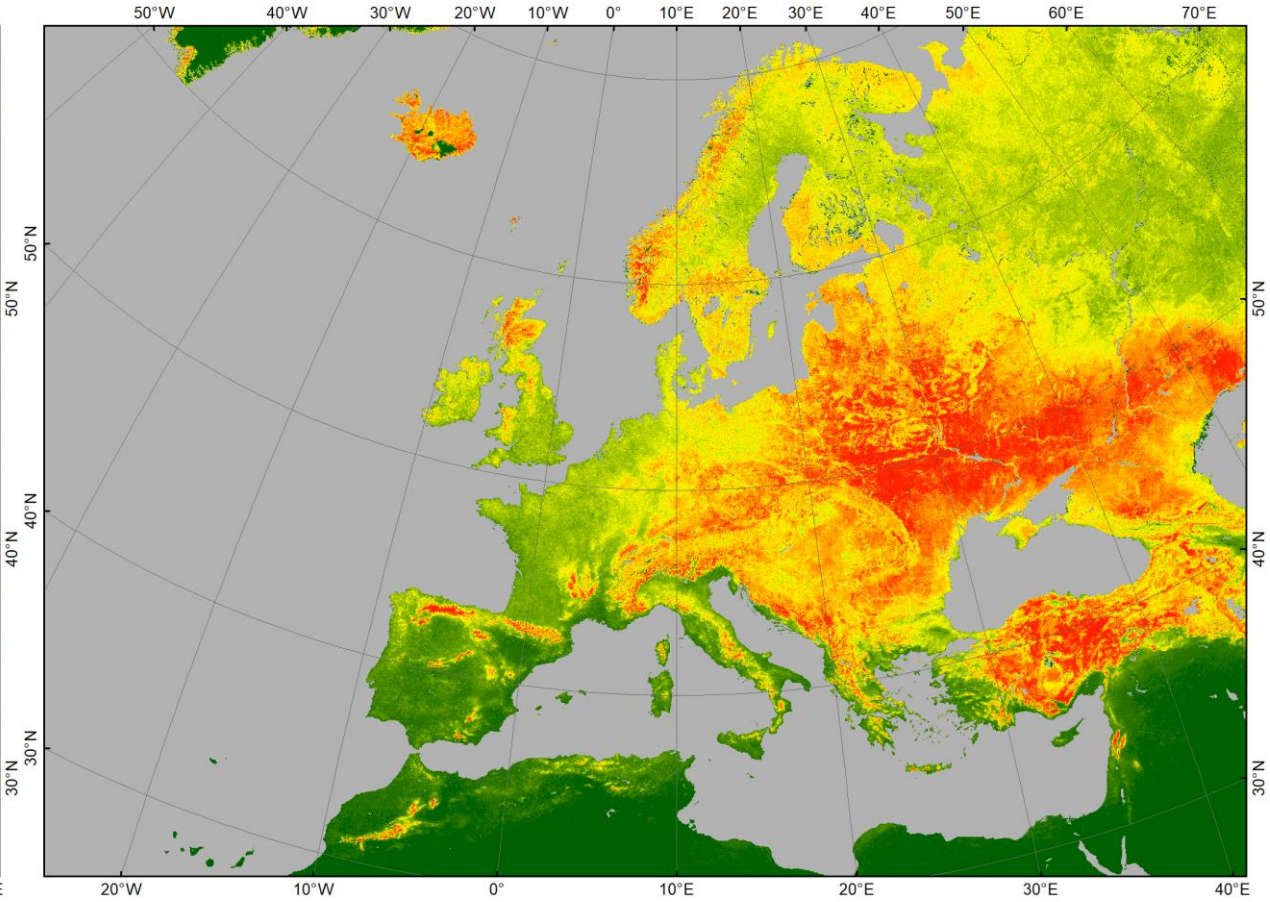
0 7.5 15

Late Snow Cover Duration: Mean & SD (1982-2018)



Late SCD in Days

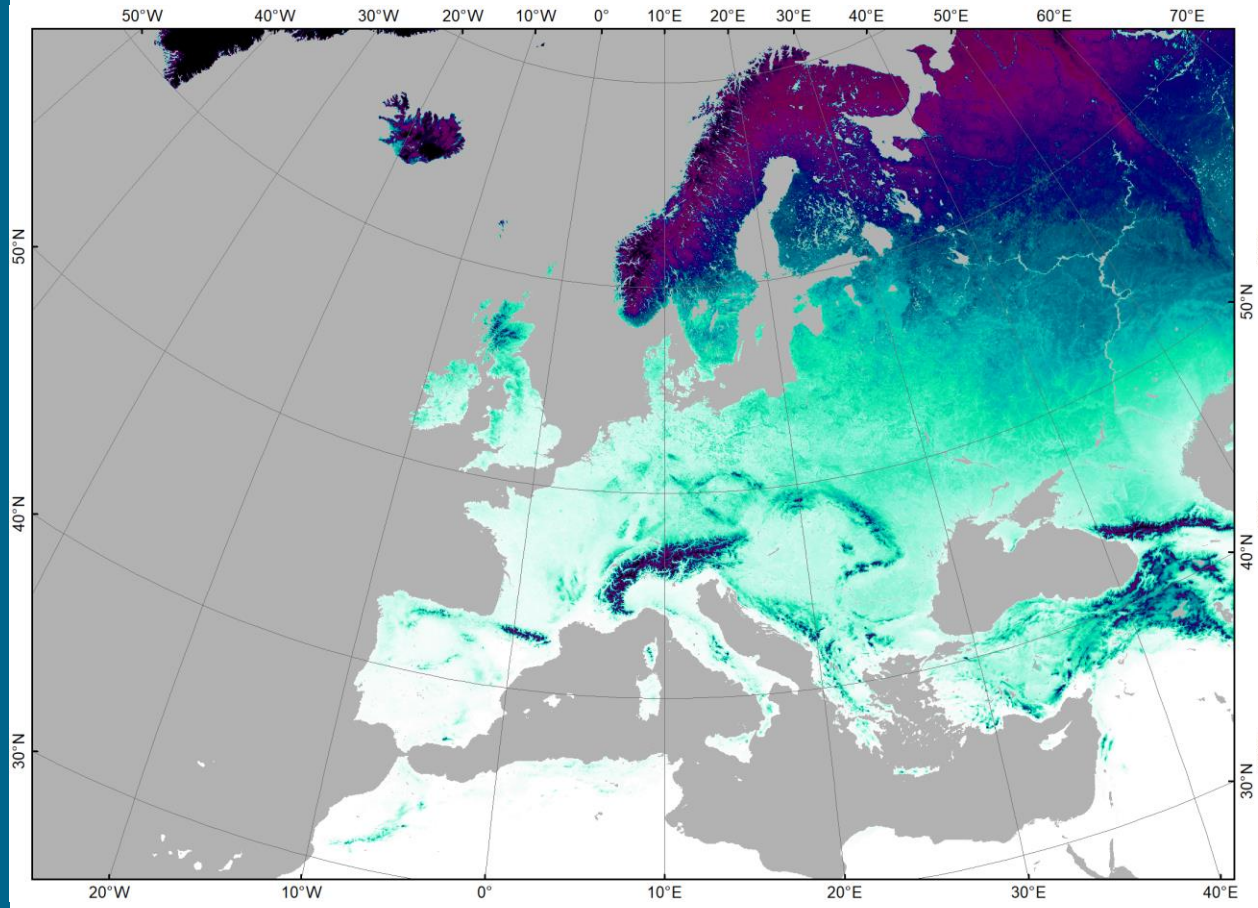
0 114/115 229/230



Standard Deviation in Days

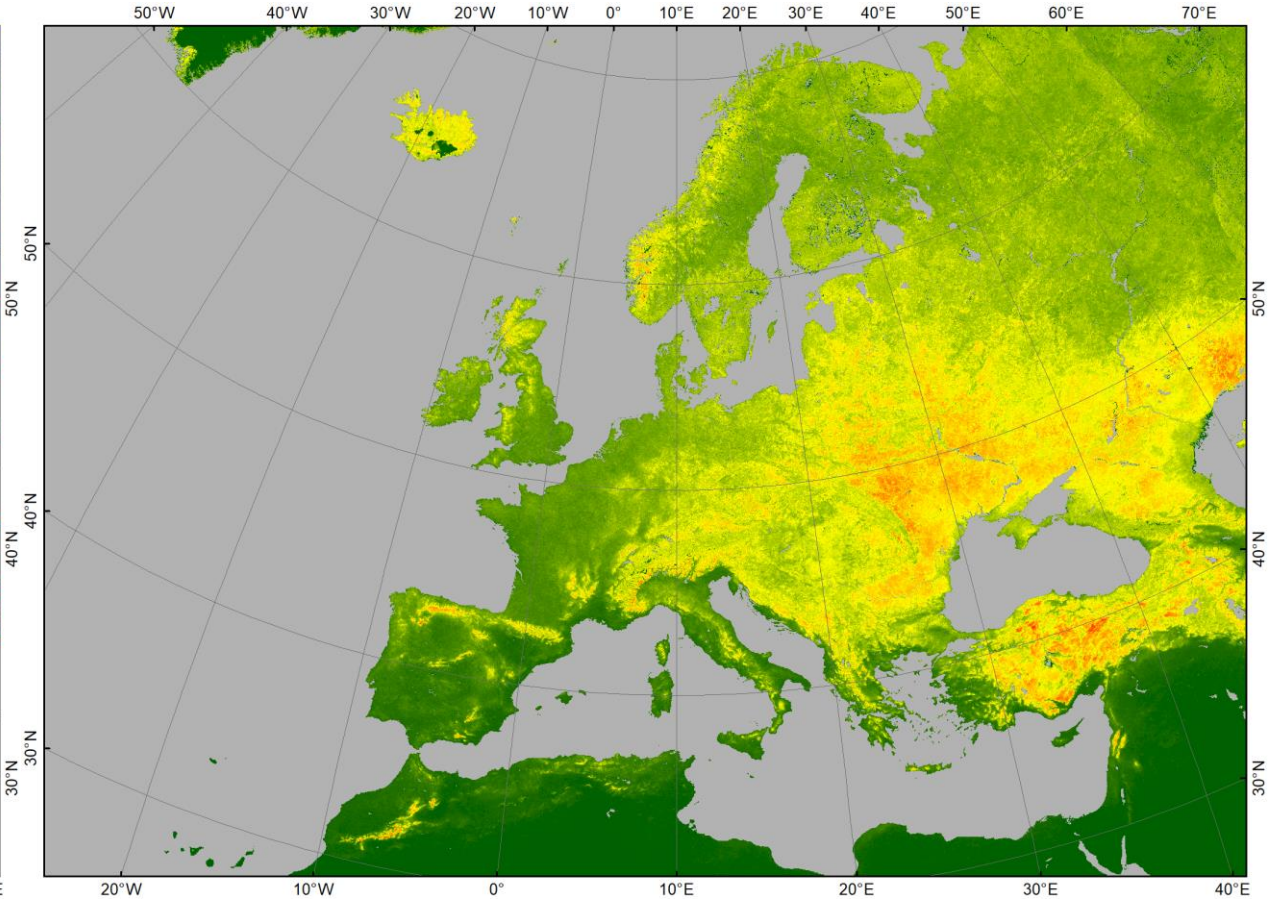
0 7.5 15

Full Snow Cover Duration: Mean & SD (1982-2018)



Full SCD in Days

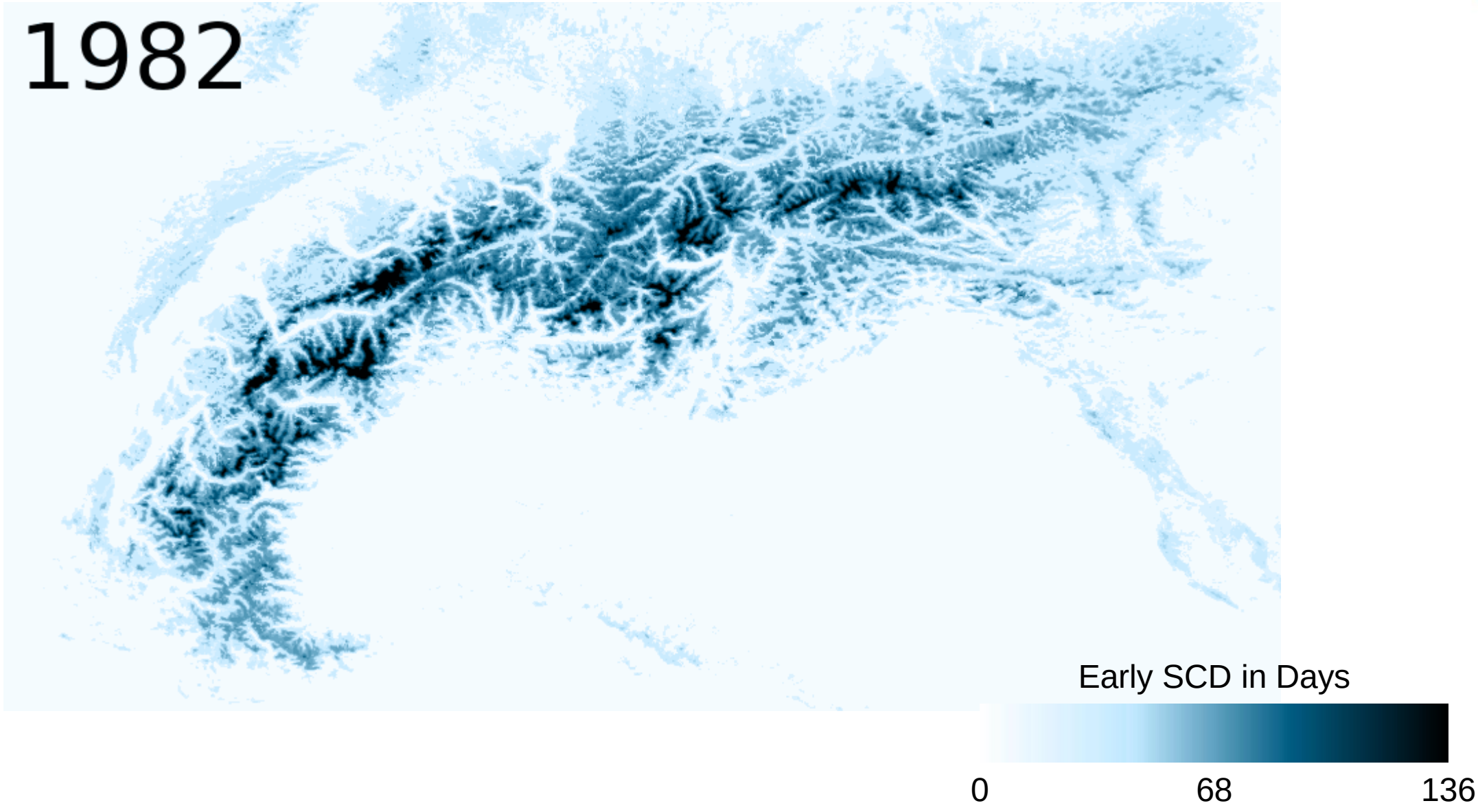
0 182/183 365/366



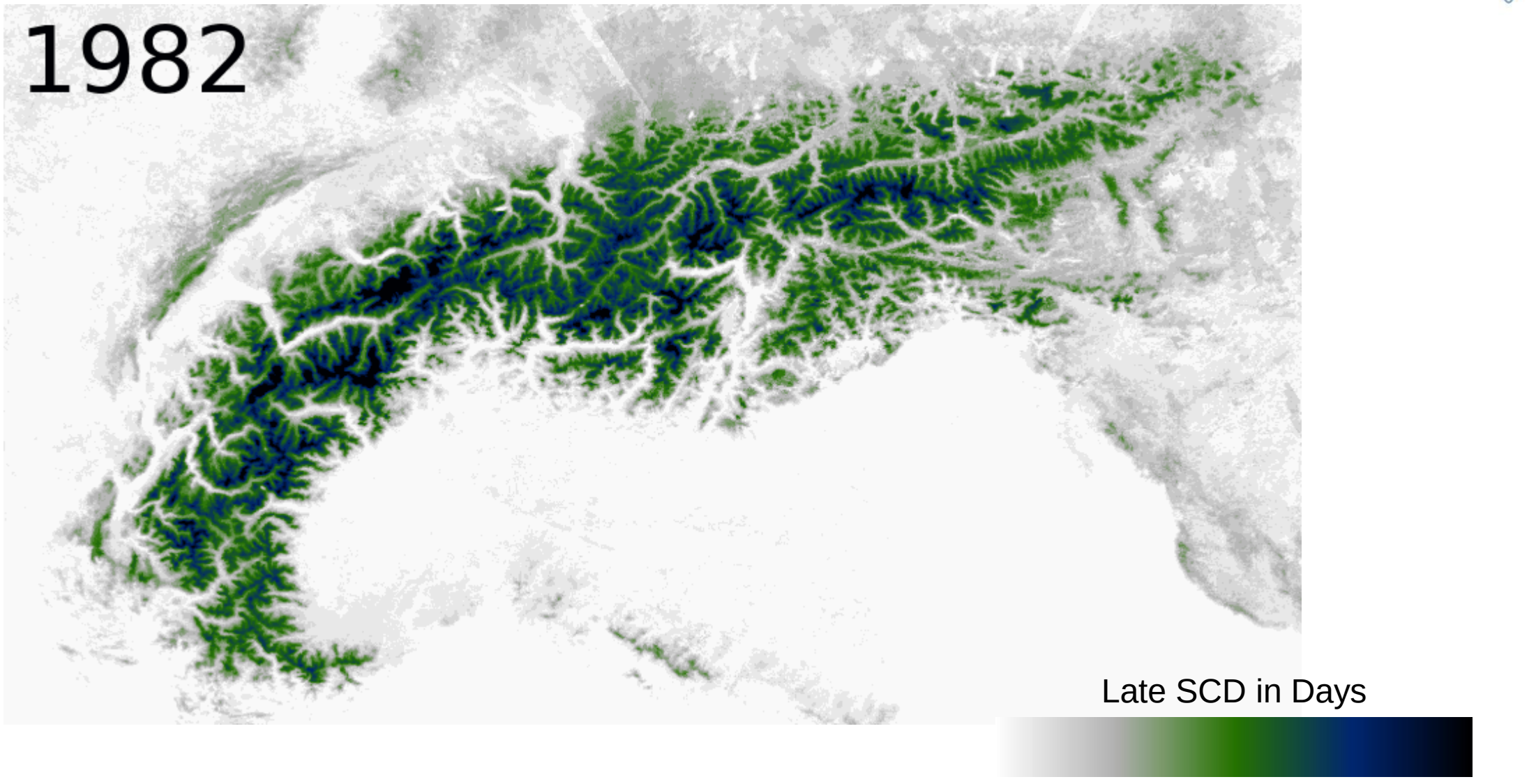
Standard Deviation in Days

0 15 30

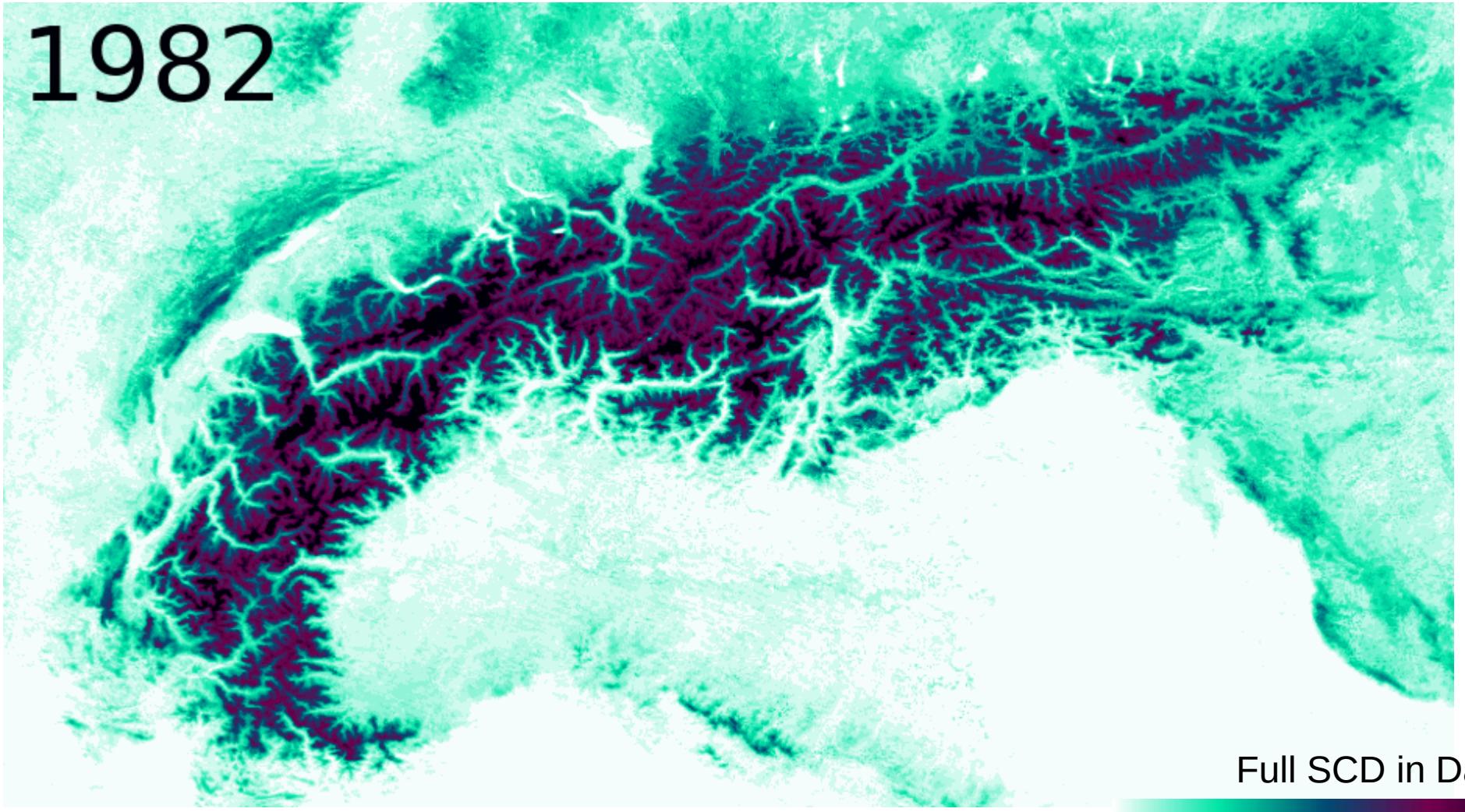
Snow Cover Duration ALPS: Early season (1982-2018)



Snow Cover Duration: Late season (1982-2018)



Snow Cover Duration: Full season (1982-2018)



Full SCD in Days

0 182/183 365/366

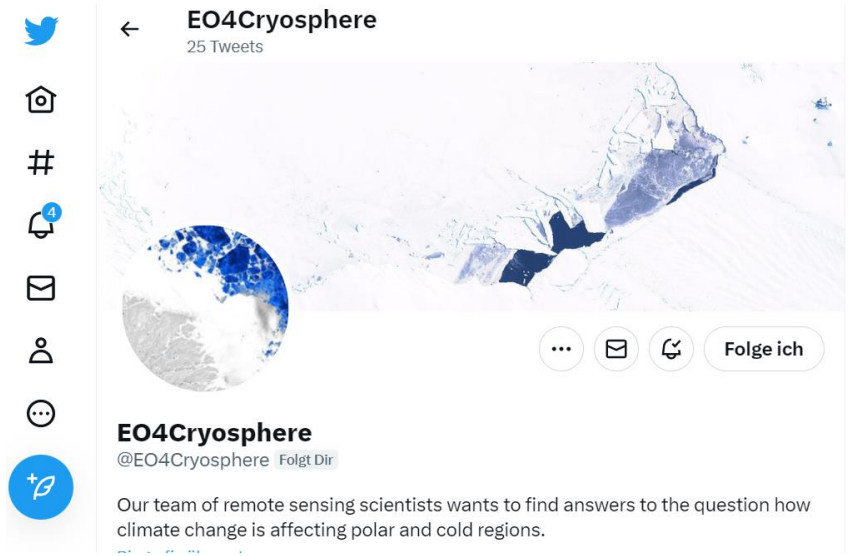
Access to the data and future steps

- TIMELINE data will be made available through EOC Geoservice: https://geoservice.dlr.de/
- TIMELINE snow cover data will be combined with DLR Global SnowPack data to produce daily, high-quality snow cover info for Euorpe since the 1980s
- The snow cover processor is currently still being optimized to reduce underestimation of snow in higher latitudes, prevent classification errors in west and south-west Europe, and reduce overestimation of cloud cover

Contact: Andreas.Dietz@dlr.de

GLOBAL SNOWPACK byEOC

TIMELINE



Contact: Andreas.Dietz@dlr.de

THANK YOU!