Mapping of geophysical land, ocean and atmosphere products over Europe from 40 years of AVHRR data – the TIMELINE project

Stefanie Holzwarth

Sarah Asam, Martin Bachmann, Martin Böttcher*, Andreas Dietz, Christina Eisfelder, Andreas Hirner, Matthias Hofmann, Grit Kirches*, Detmar Krause, Simon Plank, Thomas Popp, Philipp Reiners, Sebastian Rößler, Thomas Rupert, Alexander Scherbachenko, Ranjitha Vignesh, Meinhard Wolfmüller

German Remote Sensing Data Center (DFD), DLR

*Brockmann Consult GmbH

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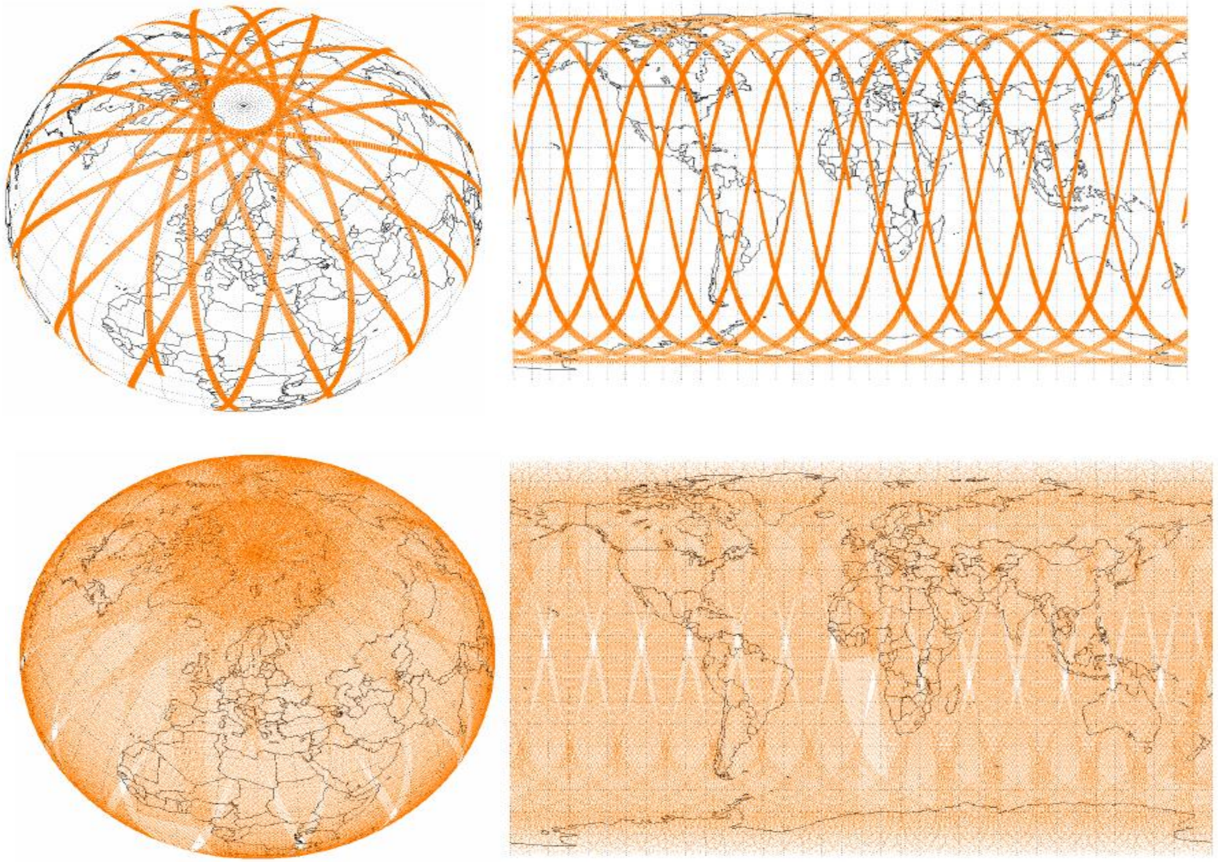
Effects of climate change on land surface dynamics

- Influence of climate change on
  - Start and length of the vegetation periods
  - Land and sea surface temperature
  - Cloud coverage
  - Number and frequency of wild fires
  - Start, extent and duration of snow cover
  - …
- Remote sensing to quantify changes of the last 40 years

Daily coverage: high- versus medium resolution

- Landsat:
  - launch of first satellite in 1972
  - 60m/30m spatial resolution
  - 4-11 spectral channels (blue, green, red, NIR, SWIR, TIR, Pan)
  - 16-day repeat cycle

- AVHRR:
  - launch of first sensor in 1978
  - 1.1km spatial resolution
  - 4-6 spectral channels (red, NIR, SWIR, TIR)
  - daily repeat cycle



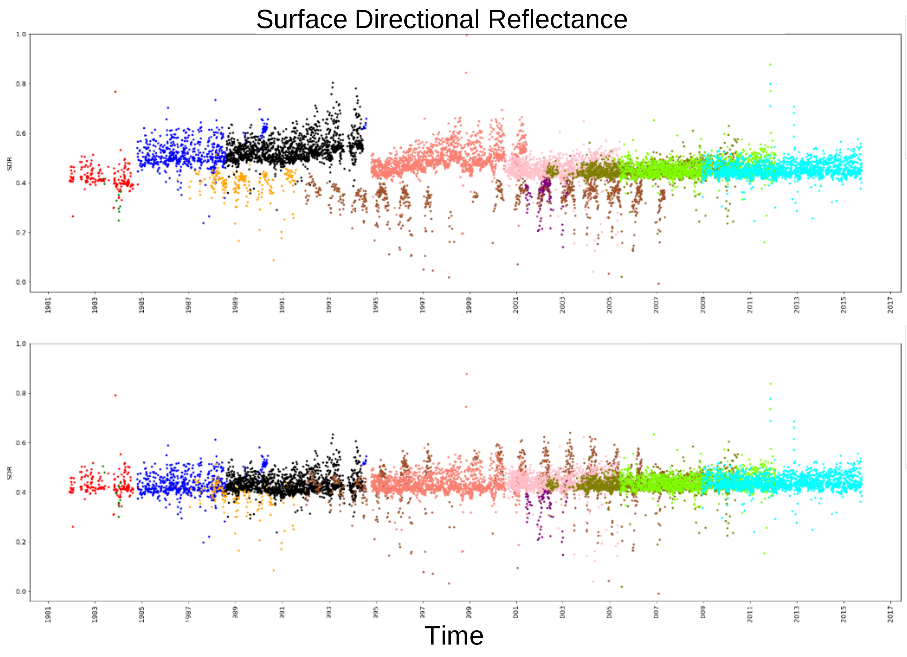
Kuenzer, C., Dech, S., Wagner, W., 2015: Remote Sensing Time Series Revealing Land Surface Dynamics: Status Quo and the Pathway Ahead. In: Künzer, C., Dech, S., Wagner, W. (eds.), 2015: Remote Sensing Time Series Analyses revealing Land Surface Dynamics. pp 2-25. ISBN 978-3-319-15967-6, Springer, The Netherlands

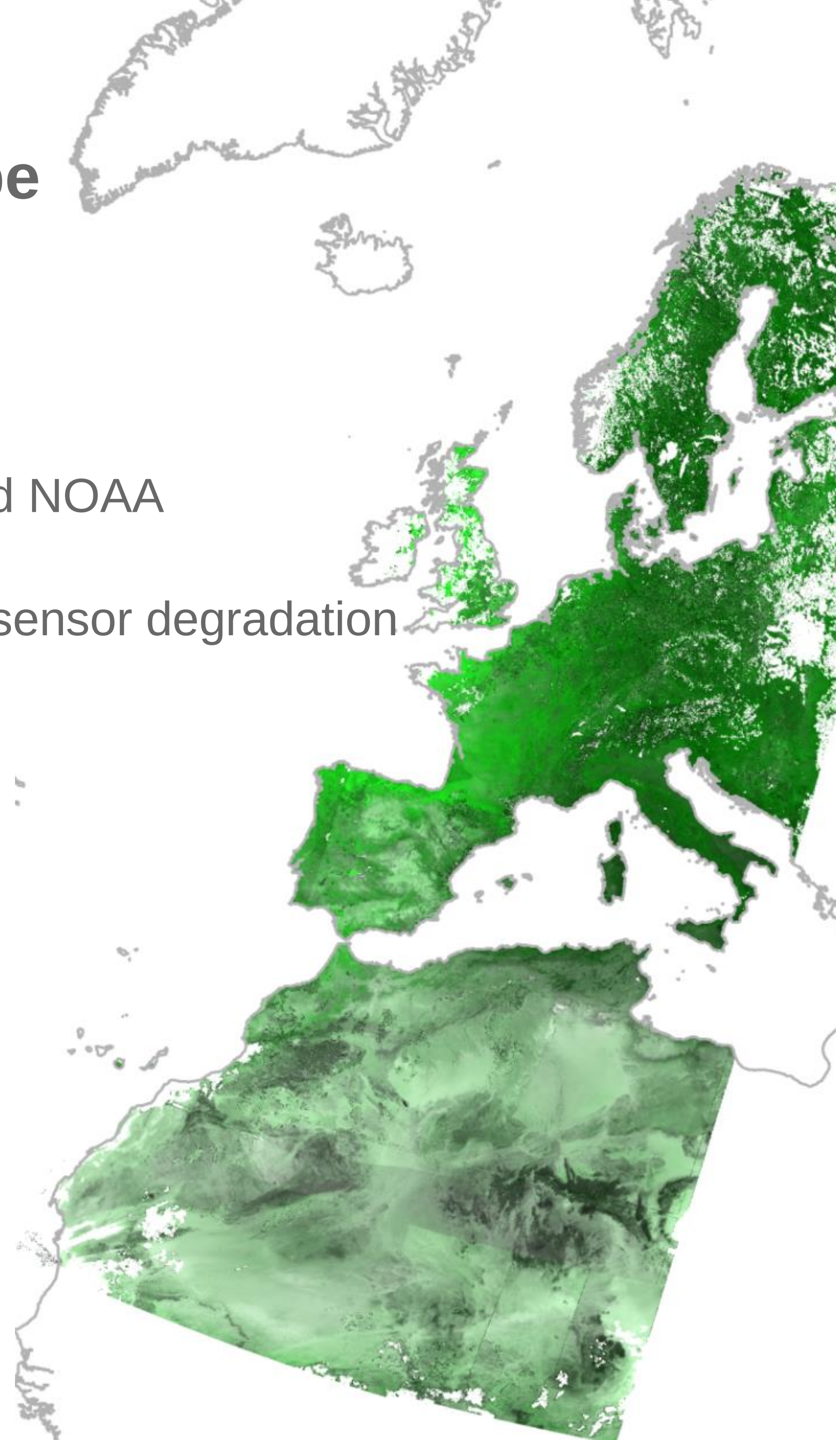
Mapping geophysical products over Europe from ~40 years of AVHRR data

Baseline:

- Sensors: AVHRR-1 (4 channels), -2 (5 channels) & -3 (6 channels) onboard NOAA and EUMETSAT satellite series (14 different platforms in total)
- Known obstacles: drifting orbits, changes of local time between platforms, sensor degradation

Extensive pre-processing of data to ensure a harmonized time series





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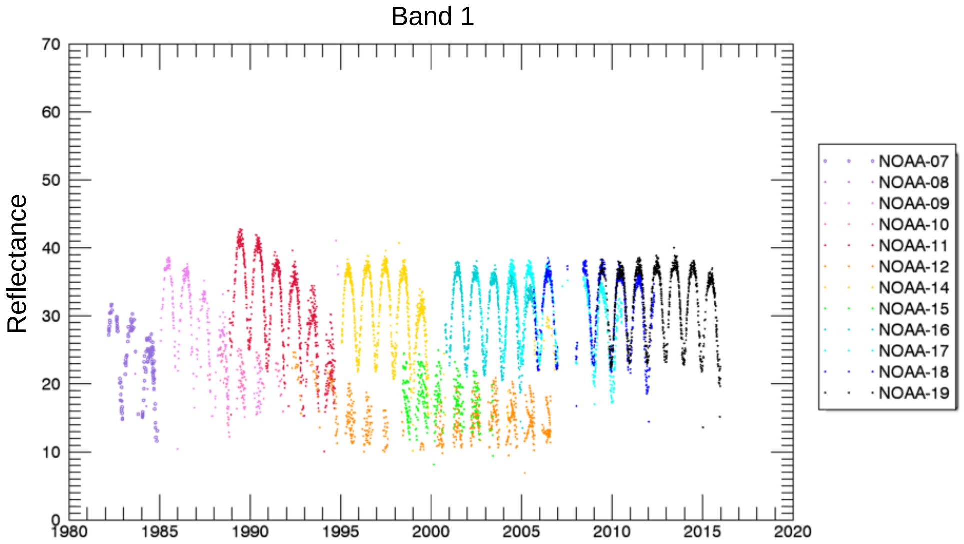
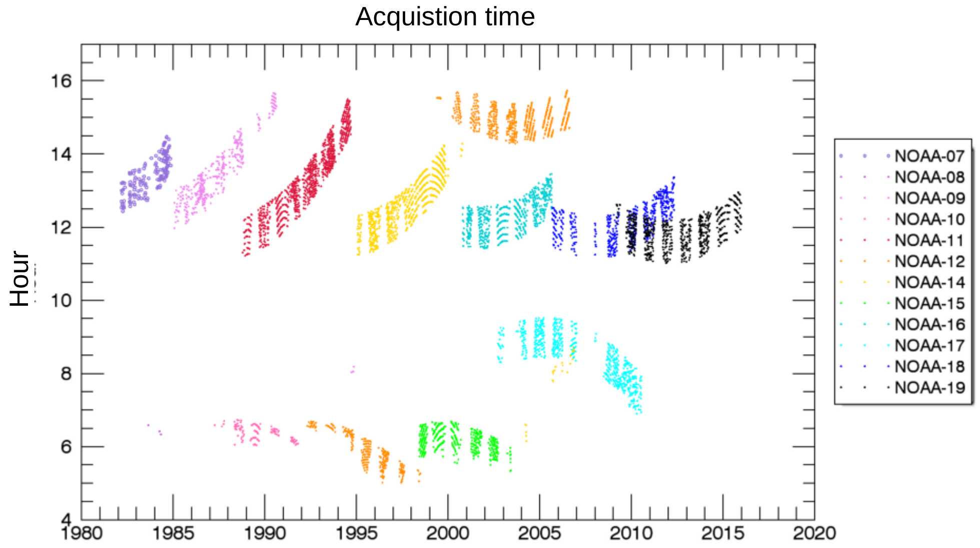
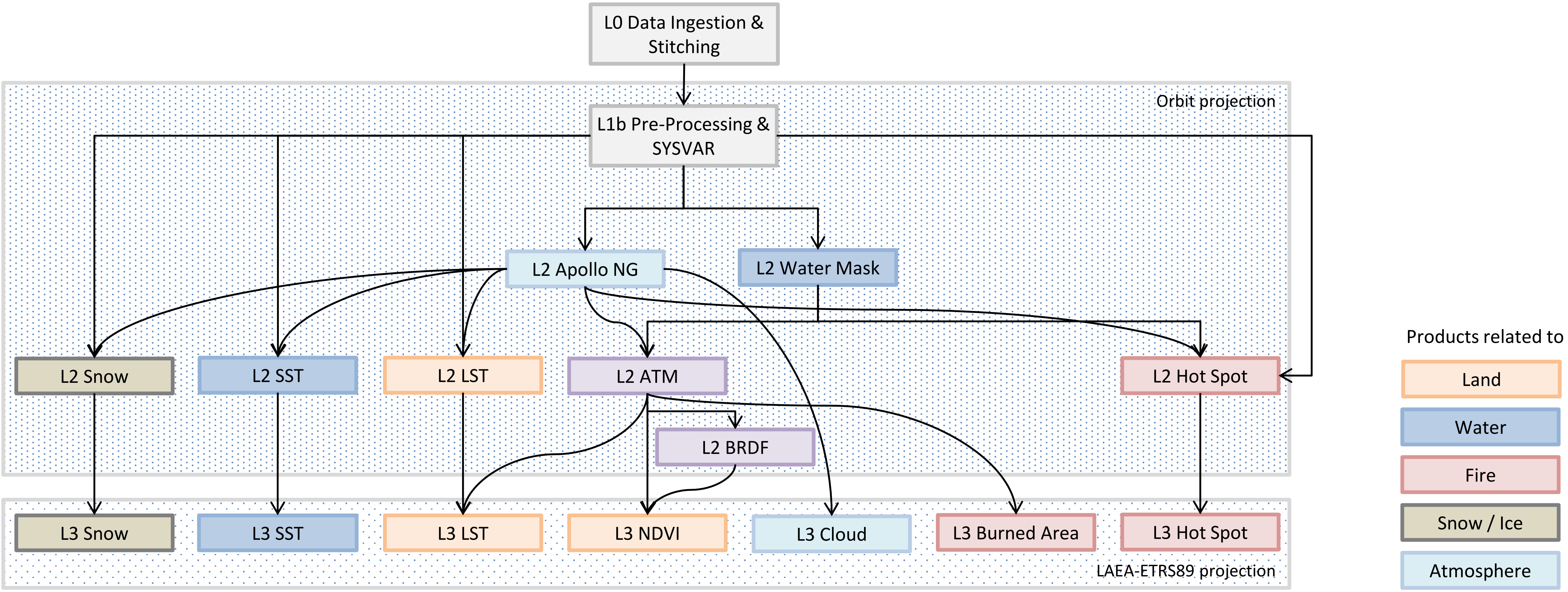
TIMELINE Challenges

- Variety of AVHRR sensors → Normalization of the sensors
- Missing on-board calibration → Recalibration of the data
- Different acquisition times → Correction of time effects
- Orbit drift → Correction of angular effects
- Noise in data → Adjusted algorithms, new accuracy measures



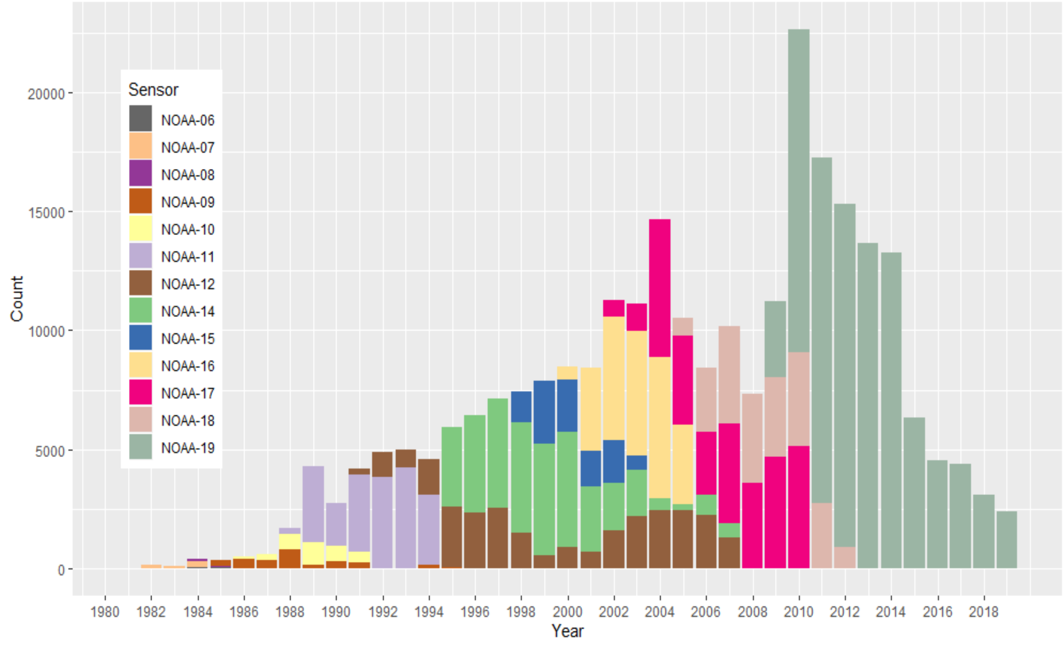


Processing workflow and product suite

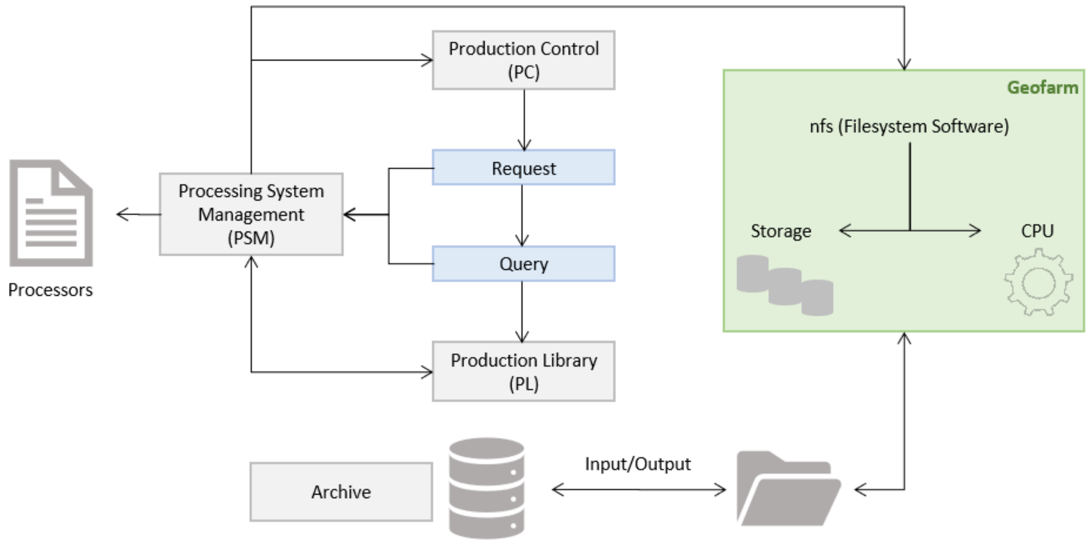


AVHRR data base and processing

Number of AVHRR scenes per NOAA sensor



Processing system

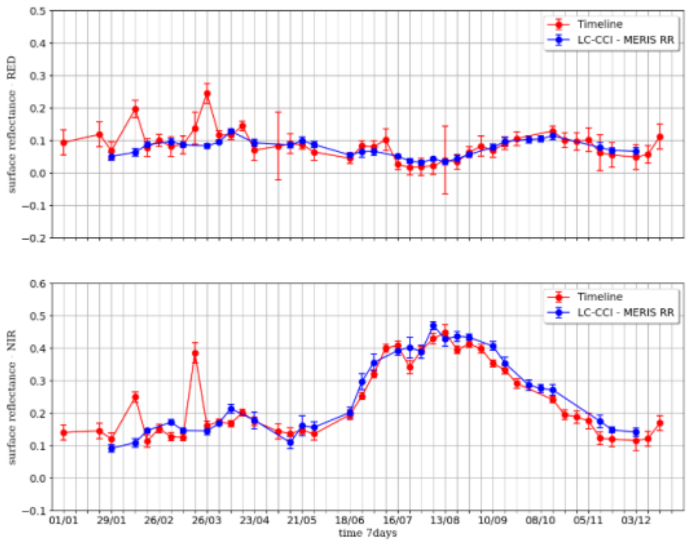


→ Processing of 128.000 raw AVHRR data to L1b products and subsequent L2 and L3 products

TIMELINE Product validation

Comparison of TIMELINE AVHRR Surface Directional Reflectance (SDR) data with SDR data from other sensors

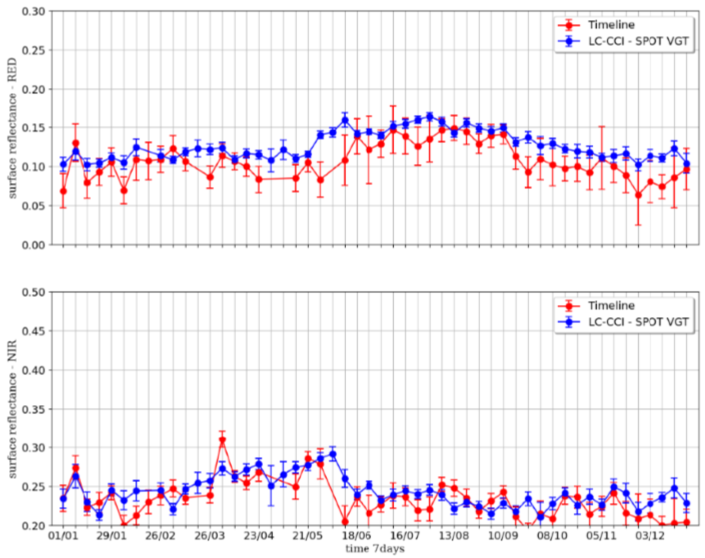
Europe_Rice_Cultivation - year 2010



AVHRR (TIMELINE)

MERIS (CCI)

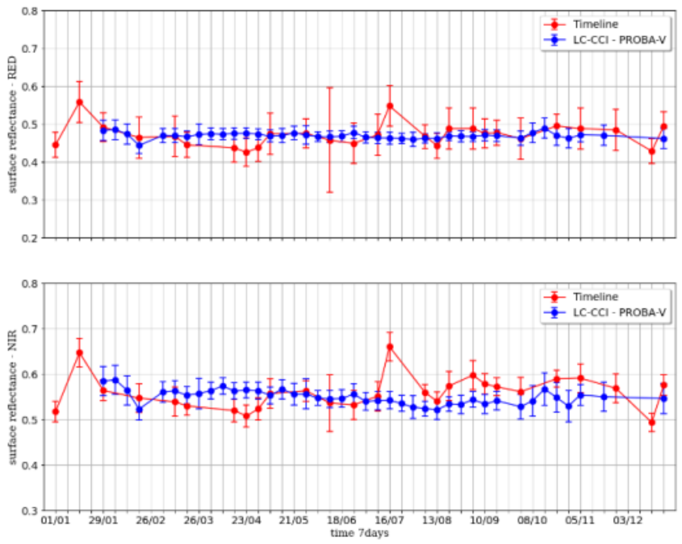
CEOS_La_Crau - year 2010



AVHRR (TIMELINE)

SPOT-VGT (CCI)

CEOS_Libya4 - year 2015

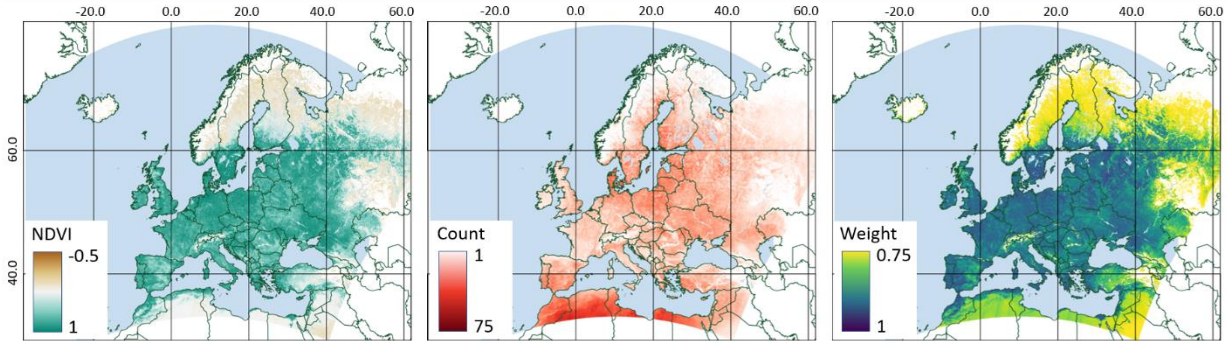


AVHRR (TIMELINE)

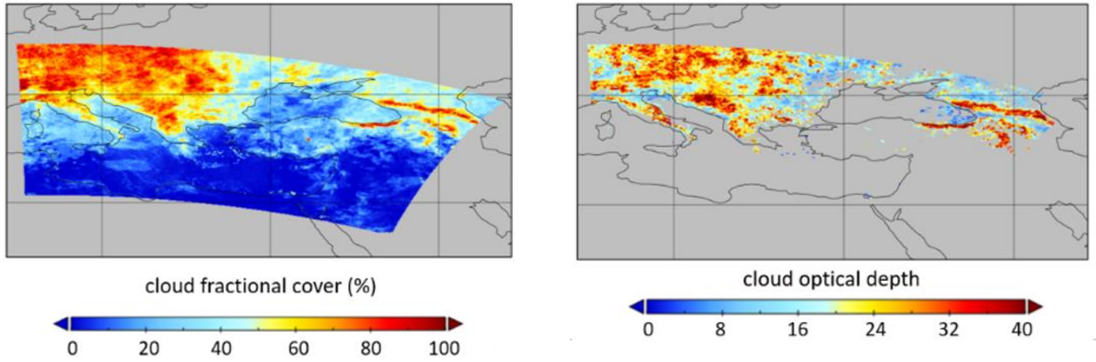
PROBA-V (CCI)

TIMELINE Product examples

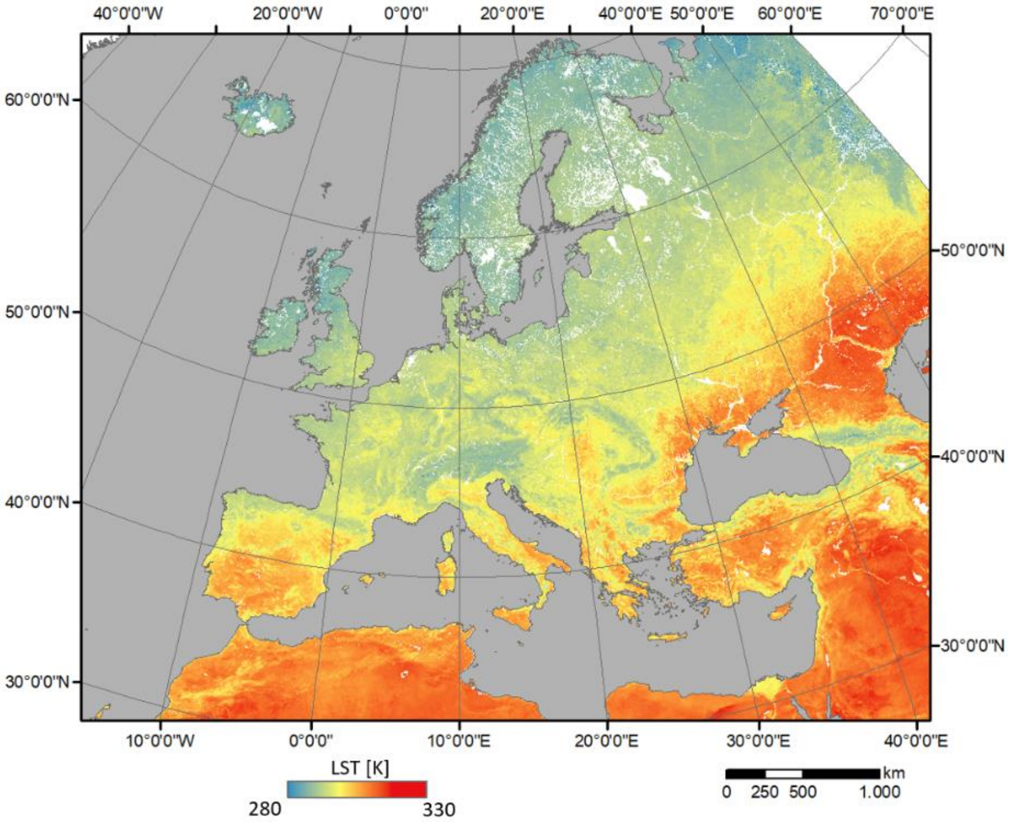
- Monthly NDVI composite for March 2007



- Cloud properties in July 2001, 14:00-15:00

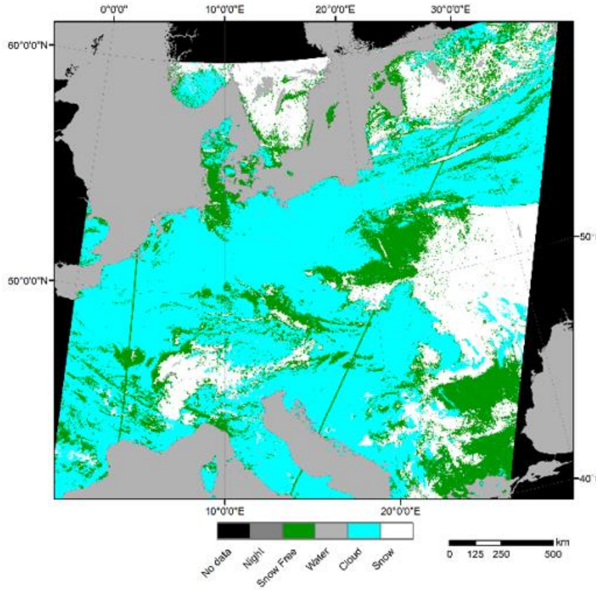


- Mean LST in August 2007

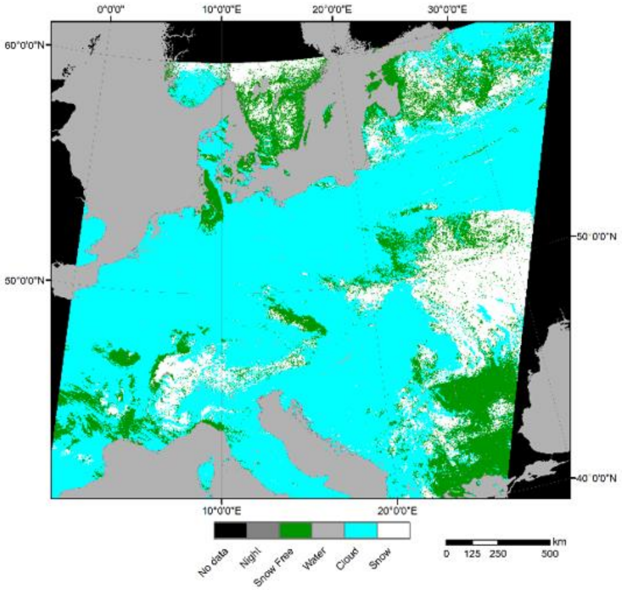


TIMELINE Product examples

- Daily snow cover composite from January 1st 2009

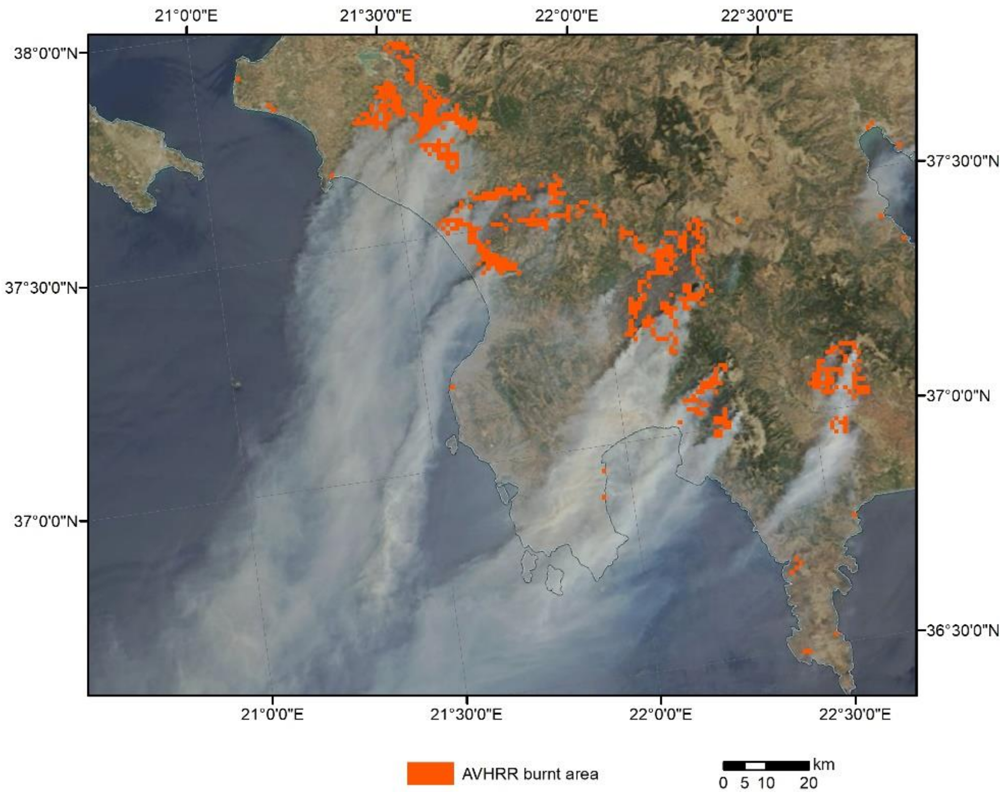


TIMELINE product



MODIS product

- Burnt areas in Greece (August 26–30, 2007)



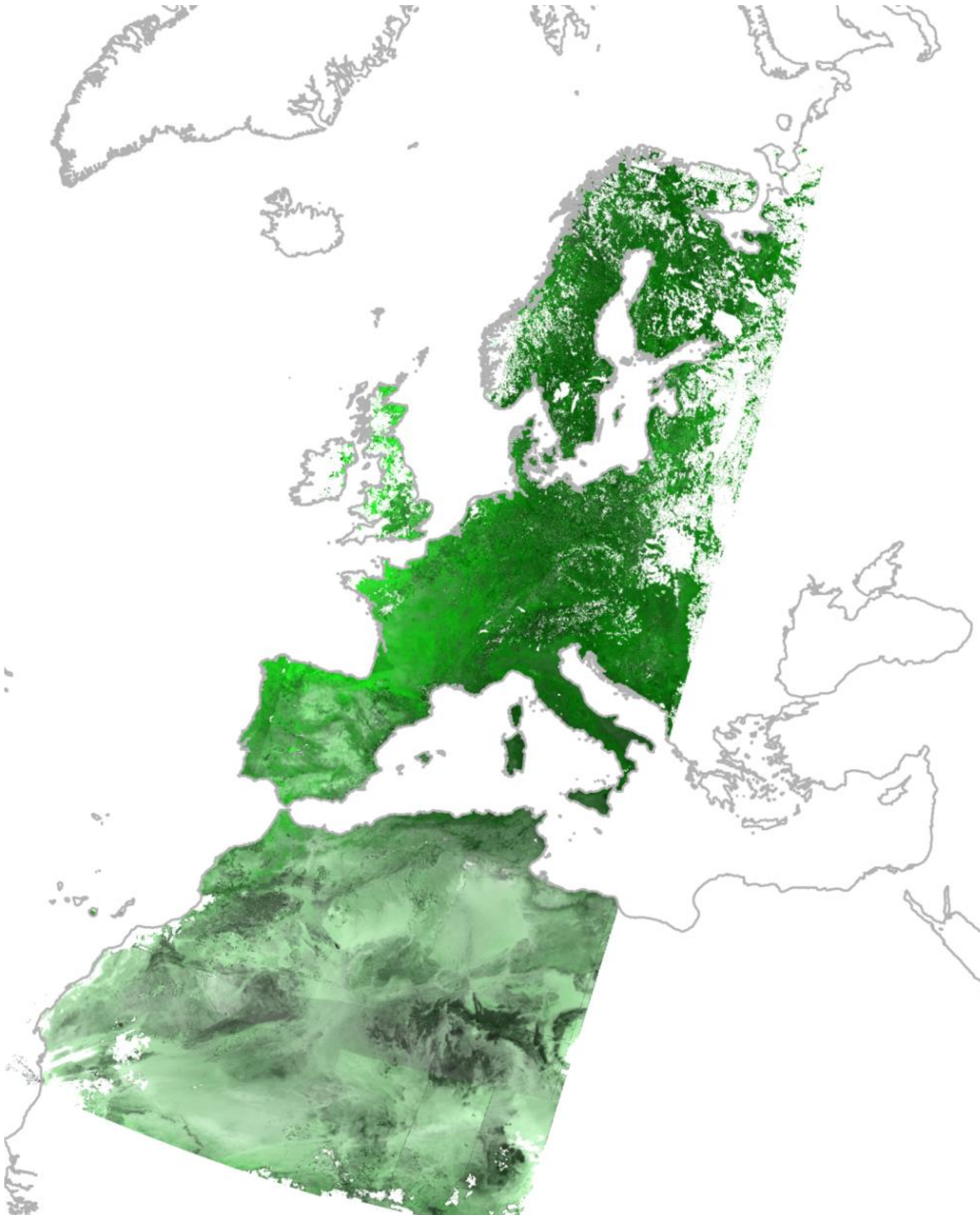
Background: MODIS image of August 26, 2007

TIMELINE Further information

… more to follow

Conclusions

- Use of ~40 years of AVHRR data
- Europe-wide products with 1.1km resolution
- Until now 500 TB of data processed
- Land, sea and atmosphere products
- Free and open dissemination intended



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