TIMELINE
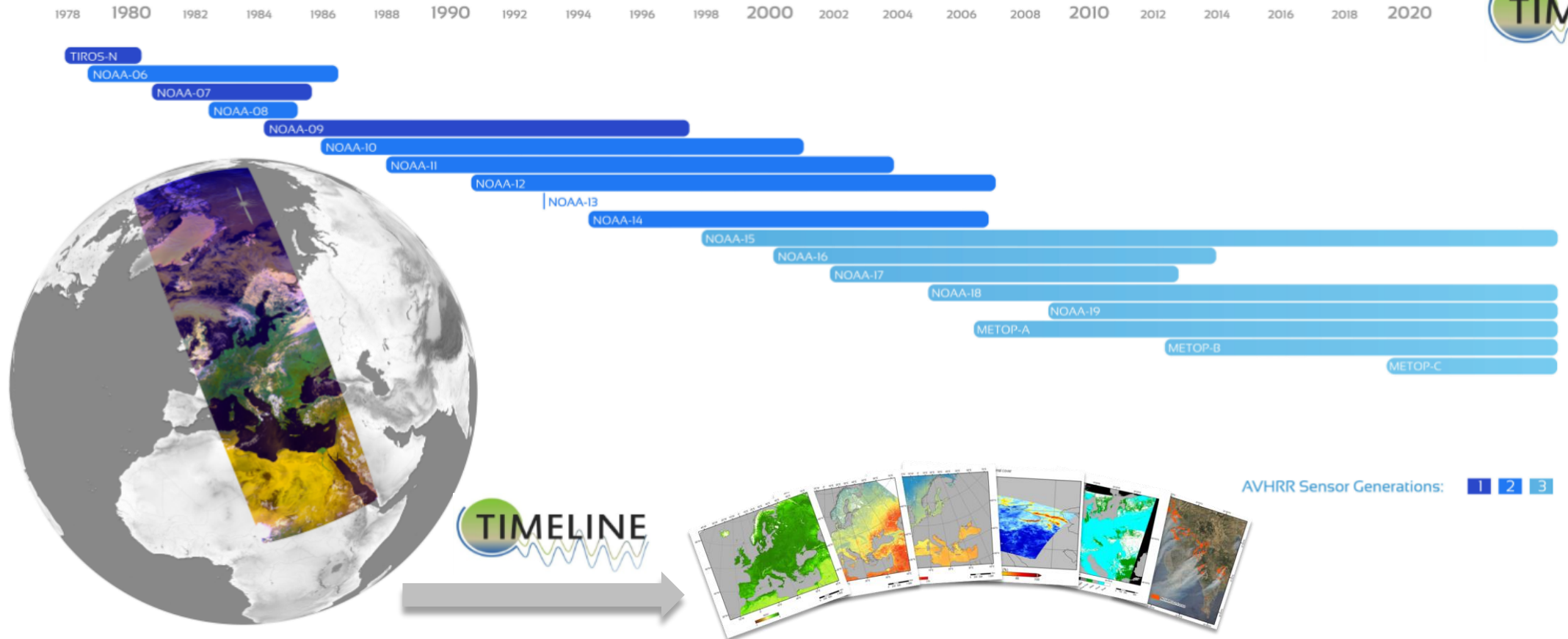# ~40 years of NOAA / MetOp AVHRR re-processing and harmonization

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G. Kirches (Brockmann Consult)

Infrared and Visible Optical Sensors (IVOS) 35
CEOS, Working Group on Calibration and Validation (WGCV)
**Oberpfaffenhofen, 27.09.2023**

DLR

The TIMELINE project: Mapping geophysical products over Europe from ~40 years of AVHRR data

- **Sensors:** AVHRR-1 (4 channels), AVHRR-2 (5 channels) & AVHRR-3 (6 channels) onboard NOAA 7 - 19 [integrated] and MetOp-A, -B, & -C [being integrated]
- **Resolution:** 1km (LAC + HRPT data)
- **Coverage:** Europe and North Africa

Challenges of processing AVHRR data

- Heterogeneous data basis:
  3 different AVHRR sensors on 14 platforms

- Orbit drift
  → correction of angular effects

- Different acquisition times
  → correction of angular effects and daytime correction

- Missing on-board calibration plus insufficient calibration coefficients
  → complex radiometric and geometric pre-processing

- Errors and noise in data
  → adjusted algorithms
  → provision of data quality measures and typical uncertainties

Band 1 reflectance at Lybia-4

Acquisition times

(Bachmann et al. 2015; Dietz et al. 2017)
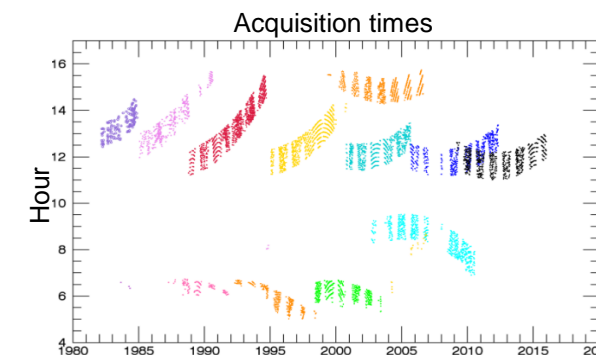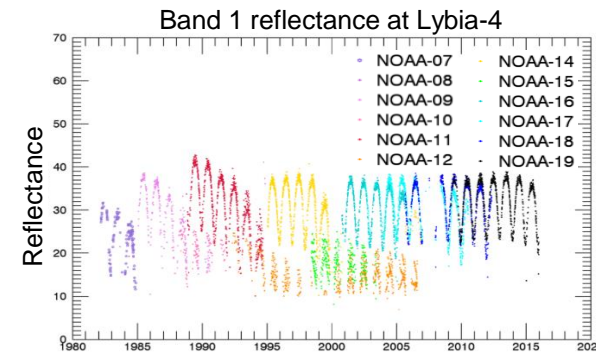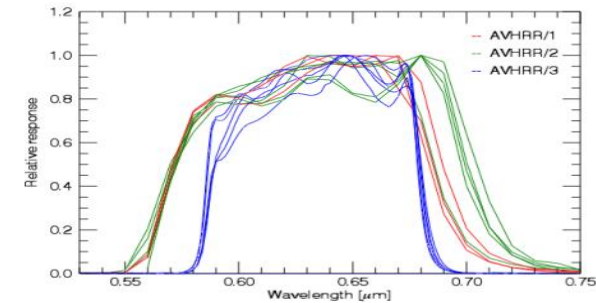
AVHRR re-processing and harmonization

Approach

- Spectral Band Adjustment Factors (SBAFs) using HYPERION data & regression models
- Atmospheric & BRDF correction using climatology (cooperation with Brockmann consult)
- Radiometric harmonization of AVHRR sensors (on top of NOAA OSPO calibration factors)
  - Low gain: using Lybia 4, cross-check with Algeria 3 (use of PICs sites)
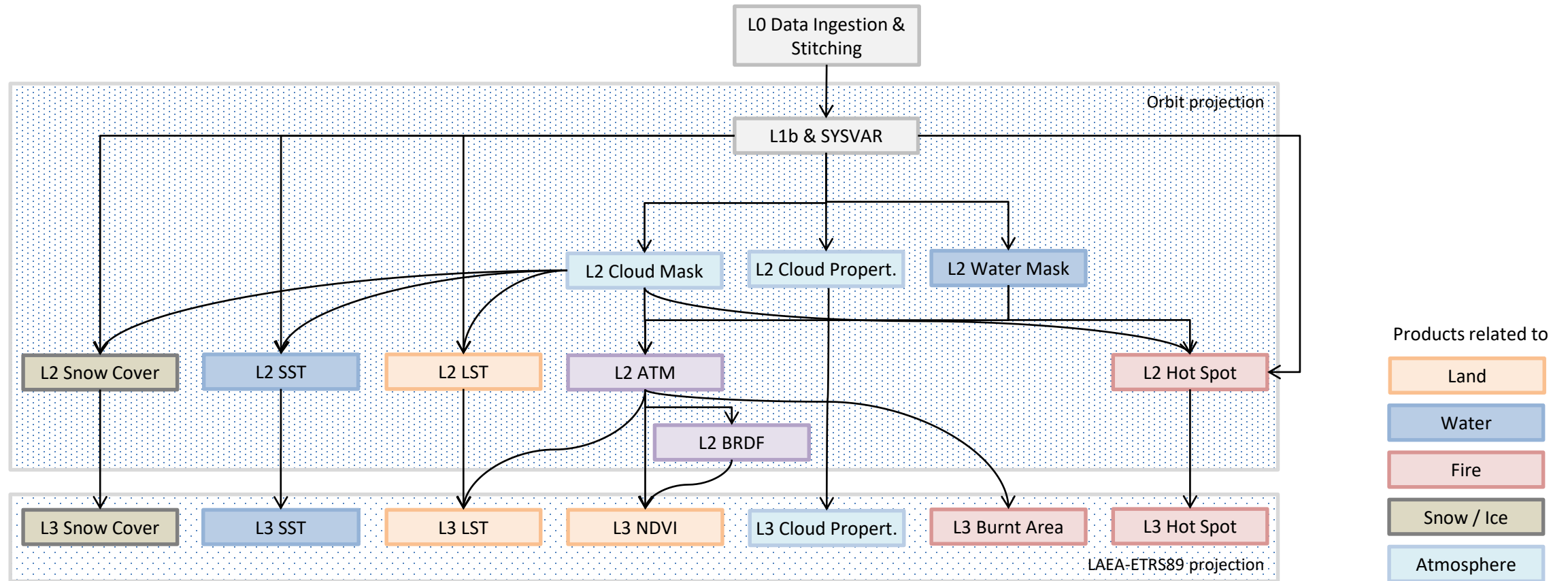 - High gain: using dark coniferous forest areas

Results

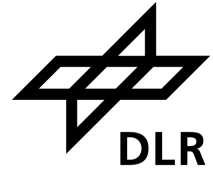- Full time series adjusted to NOAA-19 surface reflectance
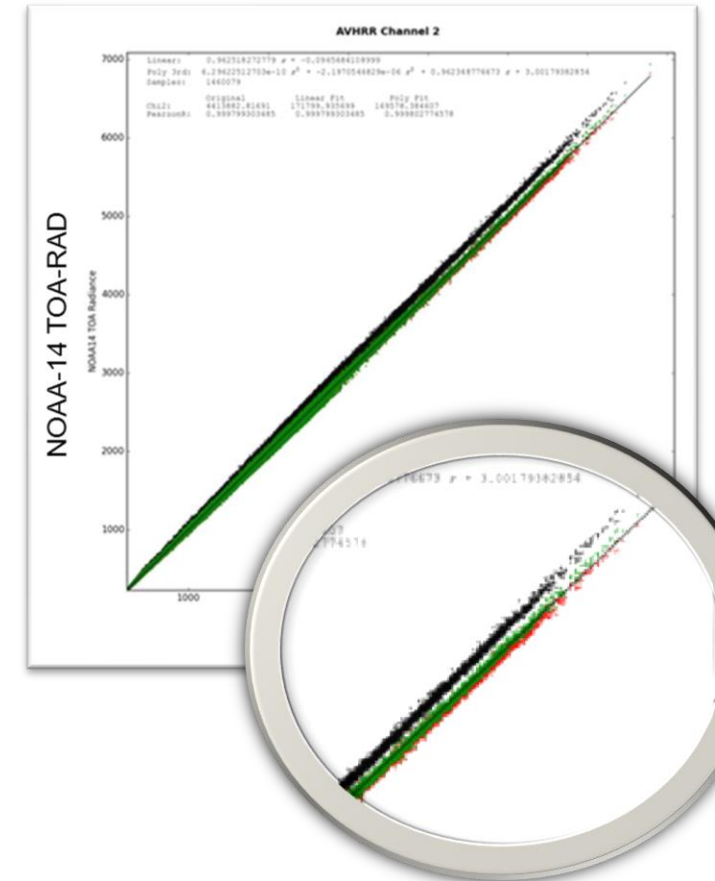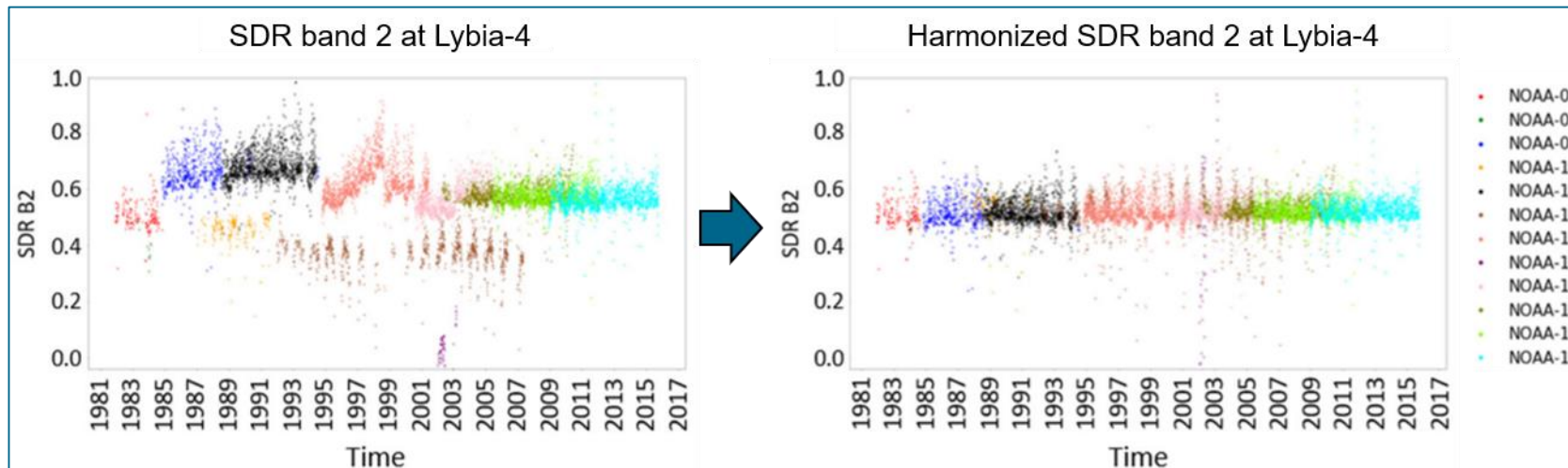
- Scatter plot of channel 2 (NOAA-14 vs. NOAA-19)
- black dots: uncorrected
- red dots: linear model
- green dots: 3rd order polynomial fit

(Bachmann & Müller 2015)

Processing workflow and product suite

(Rößler & Dietz 2022; Dech et al. 2021, Plank et al. 2018; Plank et al. 2017; Frey et al. 2017; Dietz et al. 2017; Klüser et al. 2015)
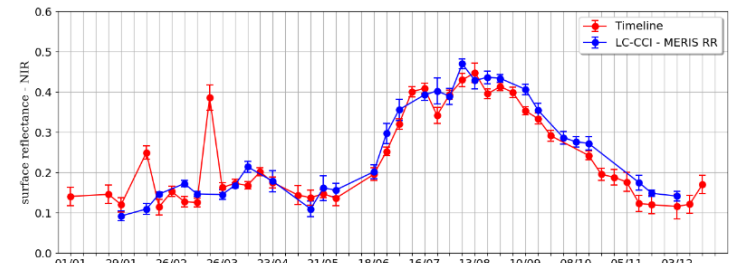
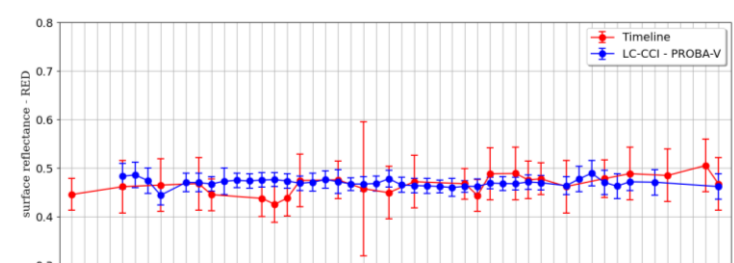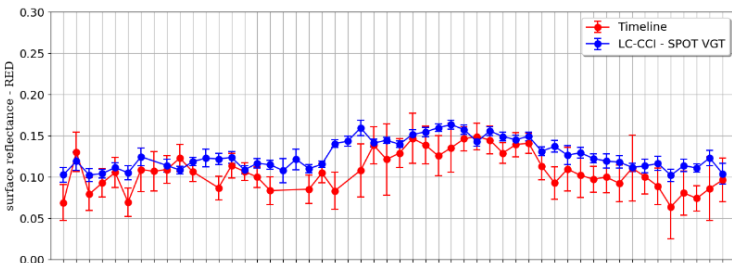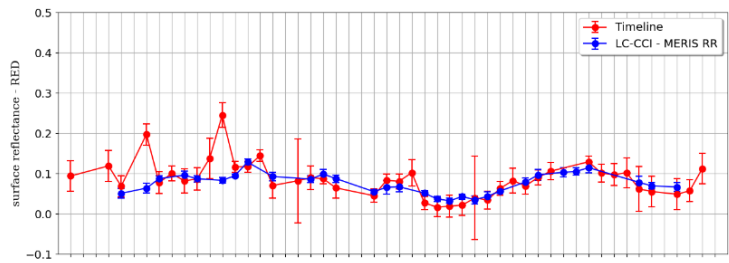# TIMELINE product validation – preliminary results

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

Europe Rice Cultivation – 2010	CEOS La Crau – 2010	CEOS Lybia4 - 2015
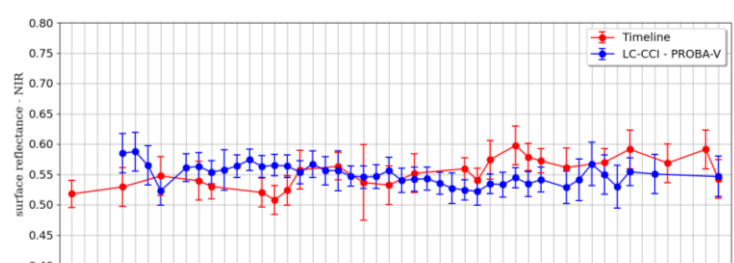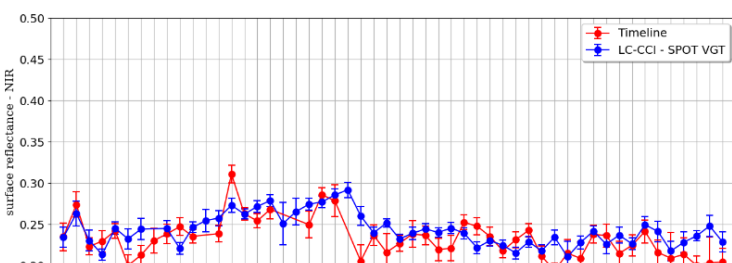
Red

NIR

AVHRR (TIMELINE)

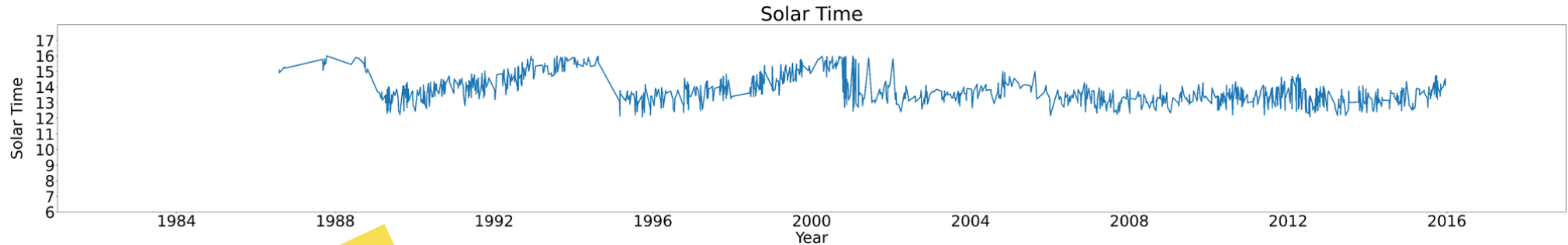MERIS (CCI)

AVHRR (TIMELINE)

SPOT-VGT (CCI)

AVHRR (TIMELINE)

PROBA-V (CCI)

(G. Kirches / Brockmann Consult)

Land Surface Temperature (LST) product validation
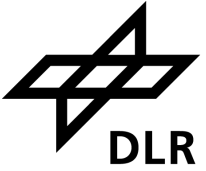
AVHRR

Landsat

– Examples –
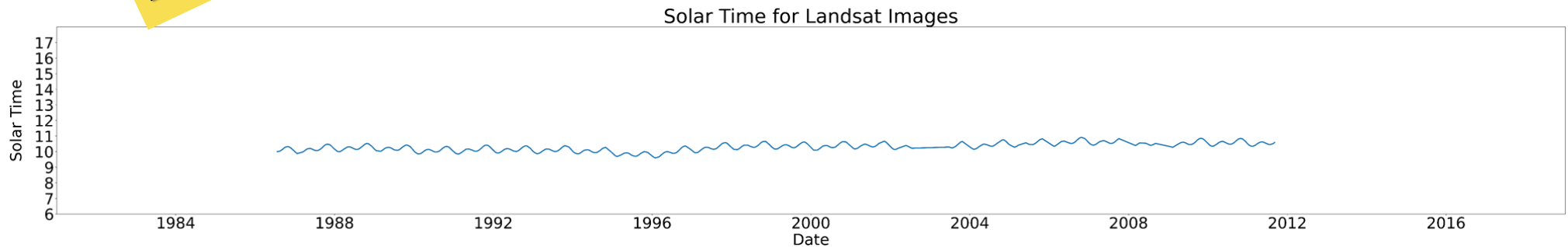
- Major issue for validation:
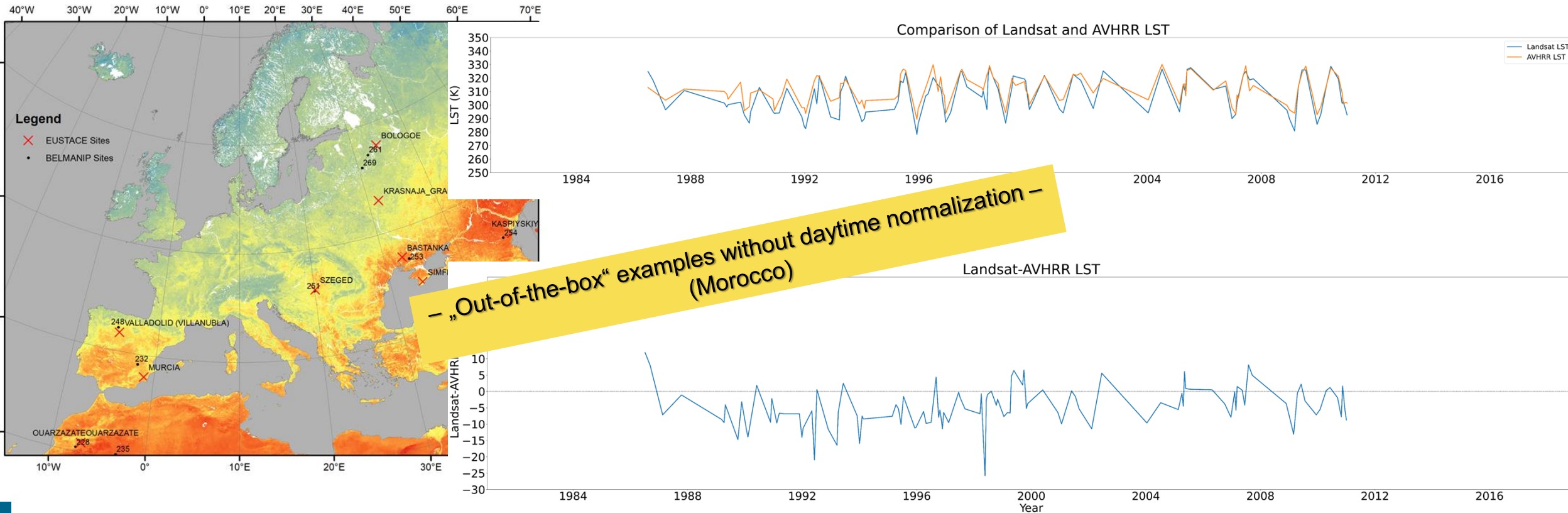 Solar time differences between sensors !

Land Surface Temperature Products

Comparison of Landsat and AVHRR LST

Landsat-AVHRR LST

– „Out-of-the-box" examples without daytime normalization – (Morocco)

- Comparison to Landsat LST for BELMANIP and EUSTACE sites
- Daytime normalization in development

Reiners, P. (2022) *Deriving Long-term Dynamics of Land Surface Temperature over Europe: Towards a Daytime normalized AVHRR LST Product.* Land Surface Temperature CCI 2022 User workshop, Harwell, United Kingdom.