Exploring the validity of the Long Term Data Record V4 database for land surface monitoring

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INTRODUCTION

Numerous datasets available for land surface monitoring.

Datasets usually focus on NDVI.

Land Surface Temperature (LST) also useful for vegetation monitoring.

Dataset recently released: NASA's Long Term Data Record version 4 (LTDRV4)

→ **We present here an assessment of the fitness of LTDRV4 for land surface monitoring.**

DATA

Datasets used in this study:

LTDRV4:
- Sensor: NOAA-AVHRR, 5 channels + cloud flag + SZA
- Daily data, at 0.05º spatial resolution
- From July 1981 to December 2013 here

PEP725 (ground phenology)
- 26 European countries
- 41 phenophases, 134 species, for 12818 different LTDRV4 pixels

WATCH Forcing Data – WFD (2m air temperature)
- 3 hr Reanalysis of ERA-interim data
- We used closest data to 14:00 (solar time) for 1981-2013.

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METHODS

1. Estimating parameters

- NDVI = (NIR-RED) / (NIR+RED) [Tucker 1979]
- LST = $T_i + a_1 (T_i - T_j) + a_2 (T_i - T_j)^2 + a_0 + (a_3 + a_4 W)(1-\varepsilon) + (a_5 + a_6 W)\Delta\varepsilon$

[Jiménez-Muñoz & Sobrino, 2008]

2. Time series reconstruction

- iterative Interpolation for Data Reconstruction [Julien & Sobrino 2010]
- modification: iteration ending threshold = smoothed rate of change

3. Retrieving annual parameters

- for NDVI and LST
- min/max values, dates, and corresponding SZA values
- mid-point crossing dates (Start and End Of Season: SOS & EOS)

[Sobrino et al. 2013]

METHODS

4. Estimating trends

- Trend presence: Mann-Kendall non-parametric trend test ($p < 0.90$)
- Trend values: Theil-Sen estimator
- for NDVI and LST min, max, SOS, EOS

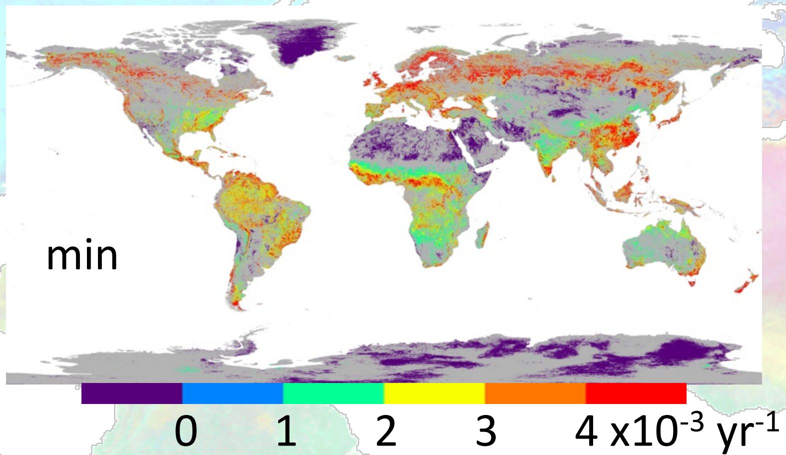
[Sobrino & Julien 2013]

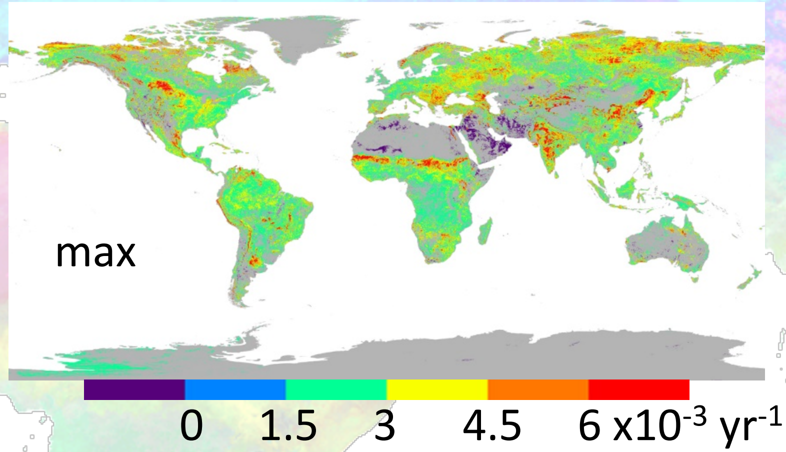
5. Estimating correlations

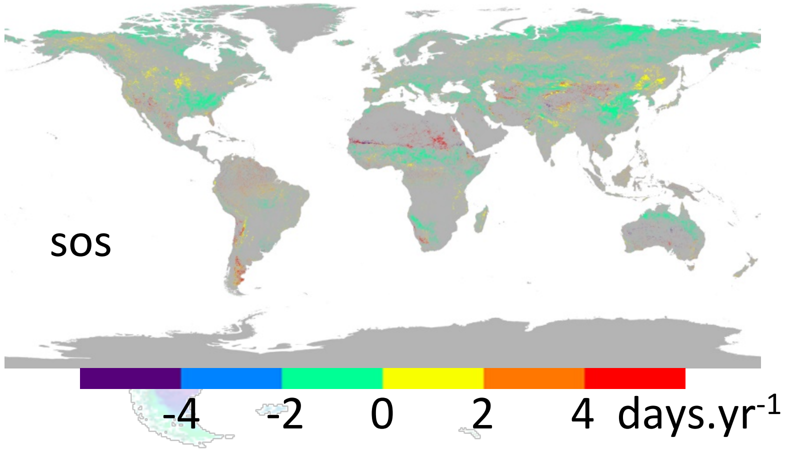
- Mann-Kendall non-parametric correlation test ($p < 0.90$)
- Between NDVI and LST min, max and SZA
- Between NDVI SOS, EOS and PEP725 phenophases
- Between LST min, max and WFD min, max air temperatures

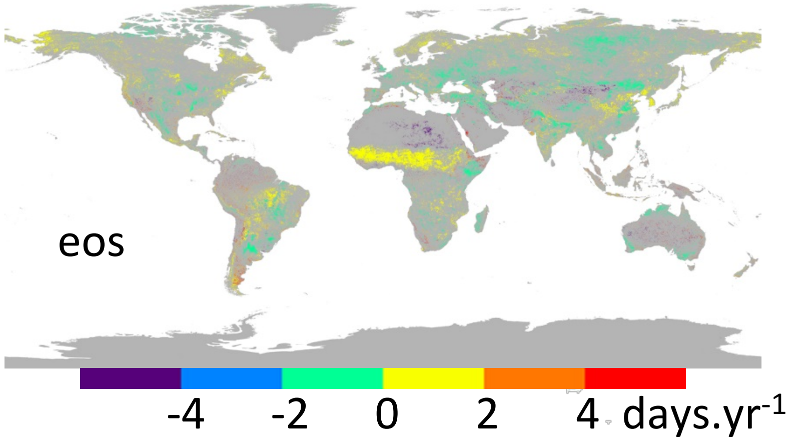
RESULTS - trends

NDVI



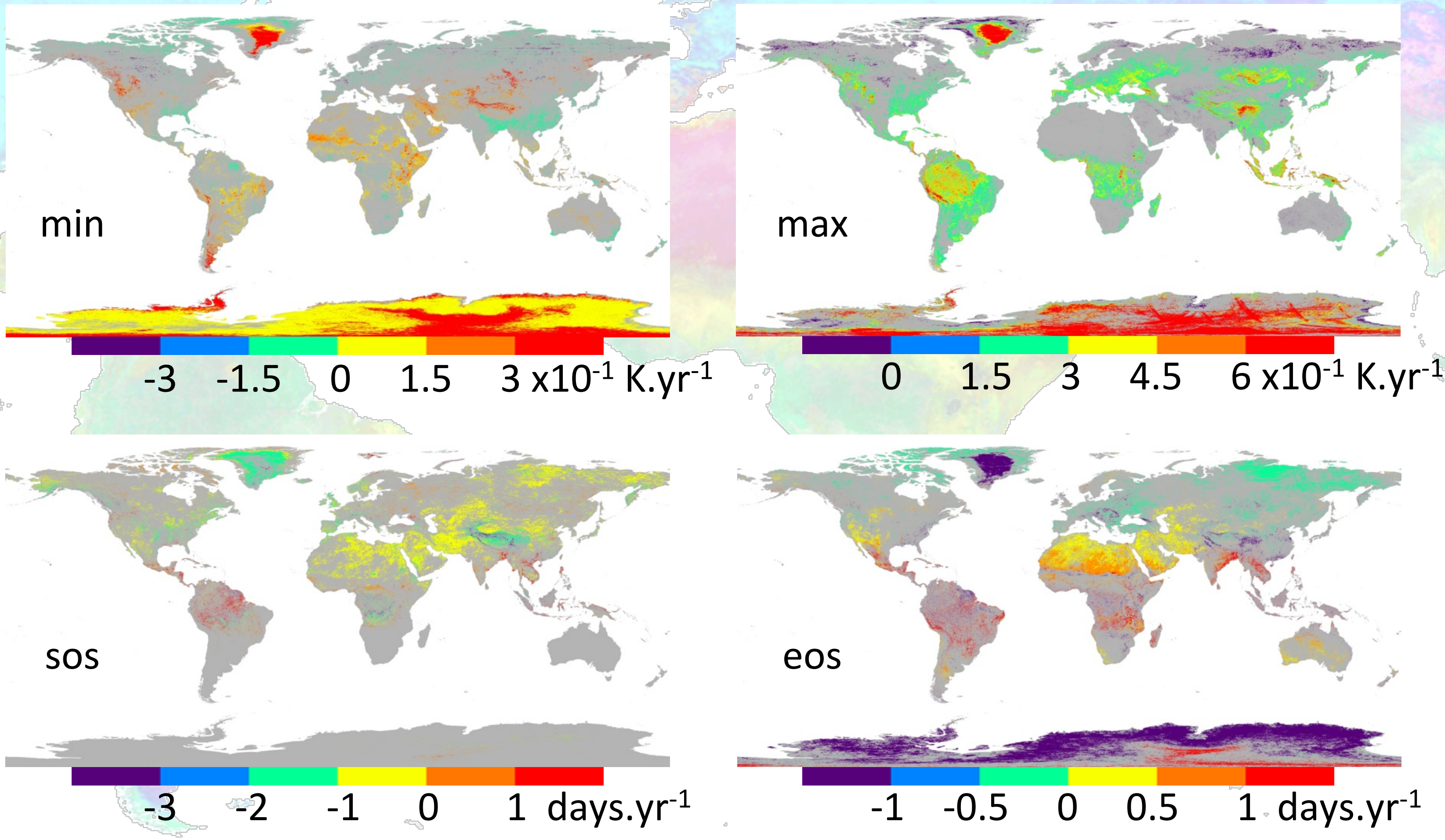






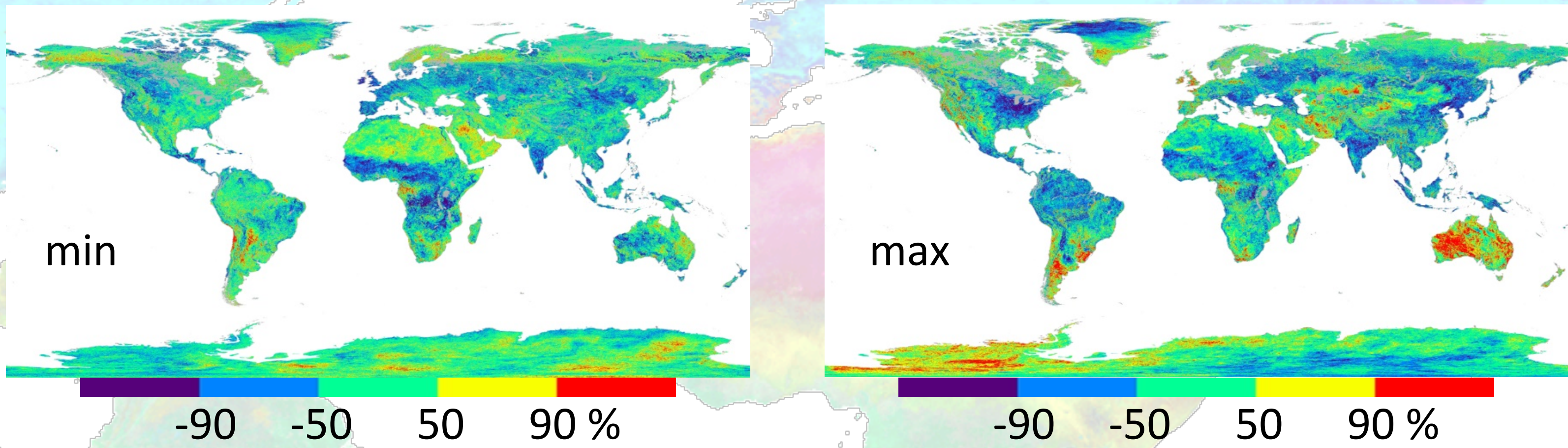
RESULTS - trends

LST



RESULTS – orbital drift

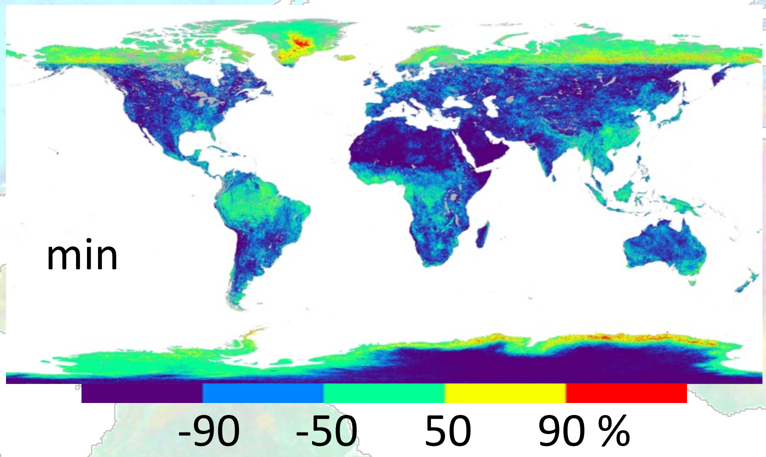
NDVI

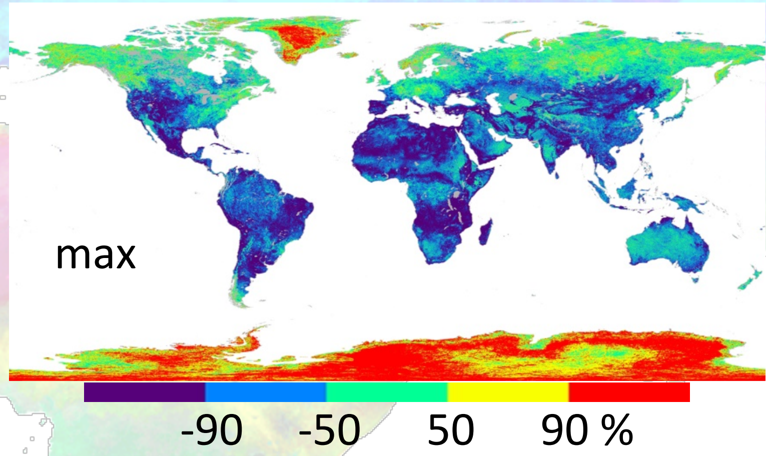


- Strong orbital drift influence for many areas, both negative and positive
- Agreement with previous work on LTDRV3 [Nagol et al. 2014]

RESULTS – orbital drift

LST

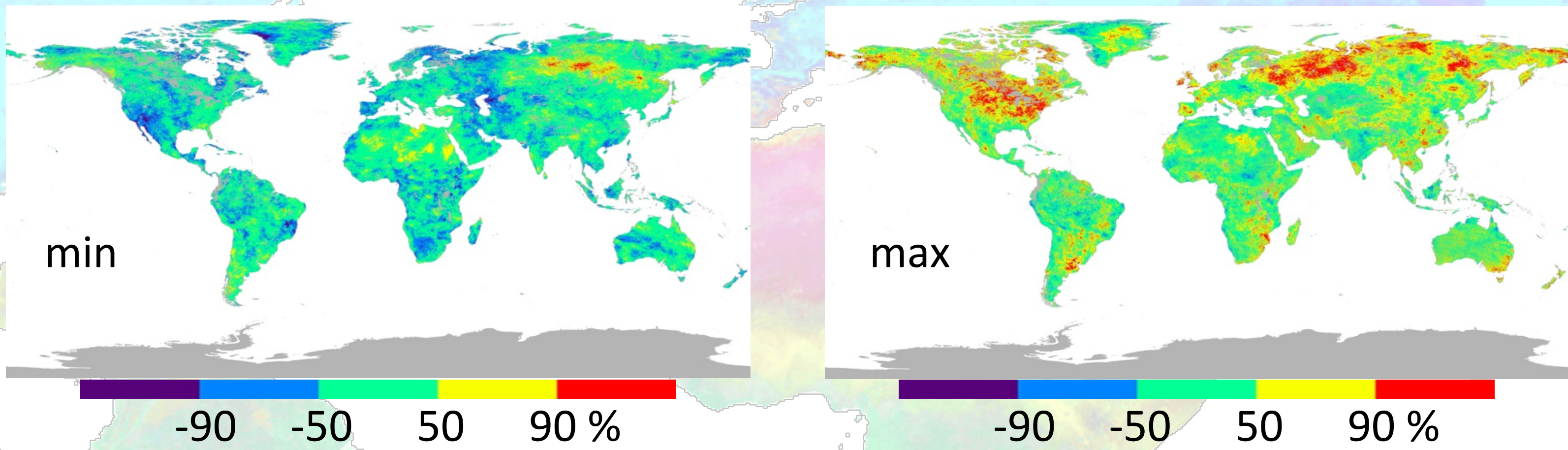




- Strong negative correlations for most areas
- Low orbital drift influence for northern temperate and polar areas

VALIDATION – temperature

Correlation LST / WFD air temperature

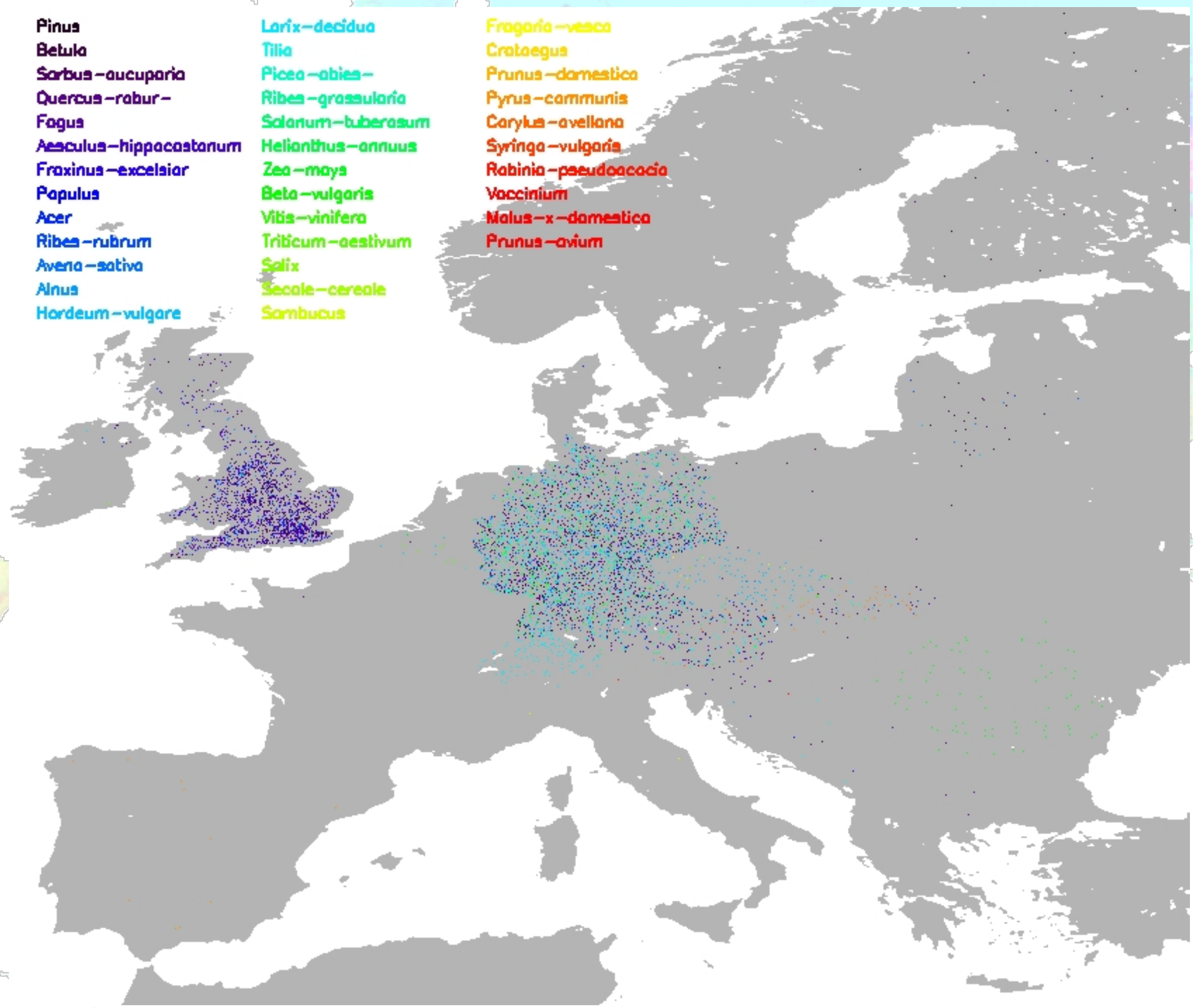


- Low correlation for min LST/ min AT expected
- High correlation for areas where low orbital drift

VALIDATION -phenology

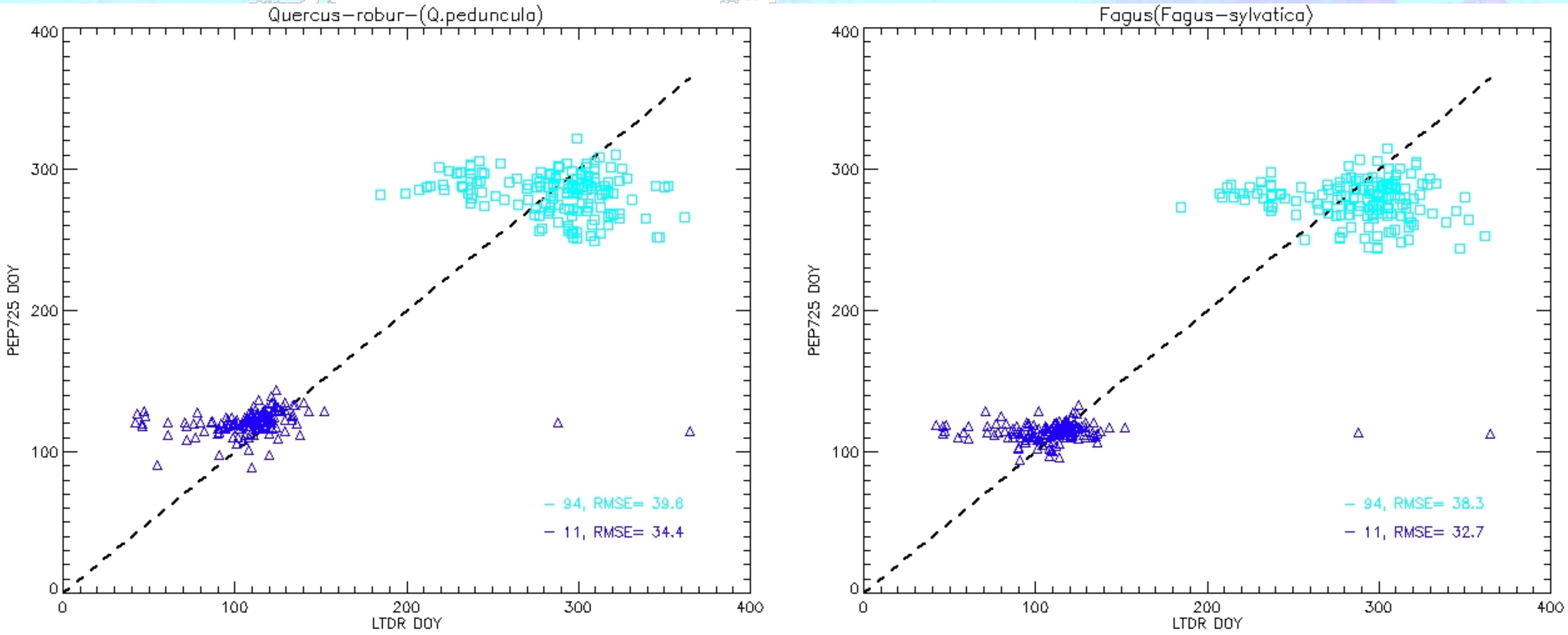
All PEP725 stations

Species corresponding to best correlation with SOS



VALIDATION -phenology

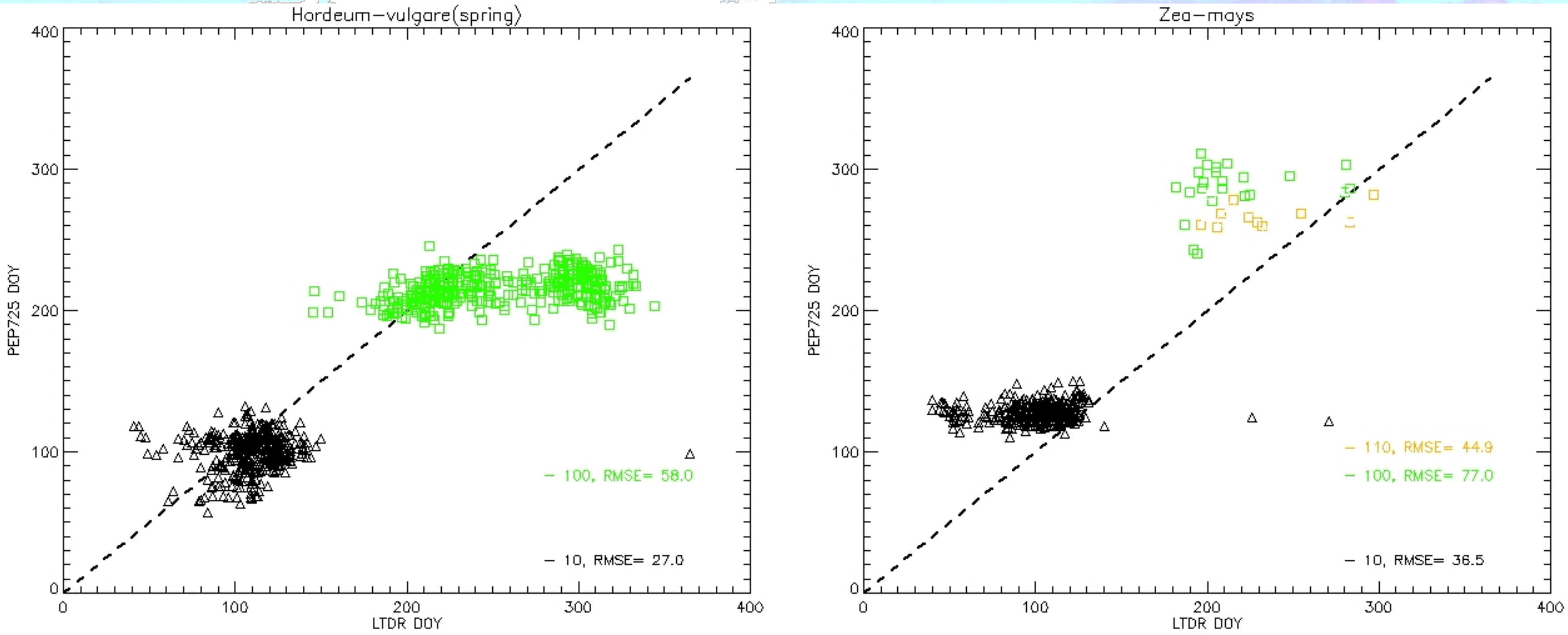
Rohrbrunn area, Germany, all years



Oak (left, 26% of area): SOS RMSE=34 days, EOS RMSE = 40 days
Beech (right, 43%): SOS RMSE=33 days, EOS RMSE = 38 days
Rest of area: mostly conifers (24%)

VALIDATION -phenology

Saxony area, Germany, all years



Barley (left): SOS RMSE=27 days, EOS RMSE = 58 days
Corn (right): SOS RMSE=37 days, EOS RMSE = 45 to 77 days
Proportion of species cultivation unknown

DISCUSSION

Phenology validation

- Some PEP725 phenophases poorly adapted to SOS and EOS comparison: first node above surface for cereals, first visible stalk for trees…
- SOS and EOS retrieval coherent and RMSE similar to usual errors

Not assessed here

- Georeferenciation:
  - 15 dates removed from dataset
  - strange statistics for coastal areas
- Cloud flag:
  - no independent ground data

CONCLUSIONS

LTDRV4

- Observed NDVI trends in agreement with previous works [Julien & Sobrino 2009]
- NDVI-derived phenology in reasonable agreement with independent data
- Strong effect of orbital drift for LST (expected)
- Where low influence of orbital drift, good agreement of LST with independent air temperatura data.

LTDRV4 fit for long term land surface monitoring provided:

- Time series reconstruction technique (NDVI & LST)
- Orbital drift correction (LST) [Julien & Sobrino 2012]

THANK YOU FOR YOUR ATTENTION

References

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