EGU2020-15936

Session Chat
07 May
08:30–10:15

Max-Planck-Institut
für Biogeochemie

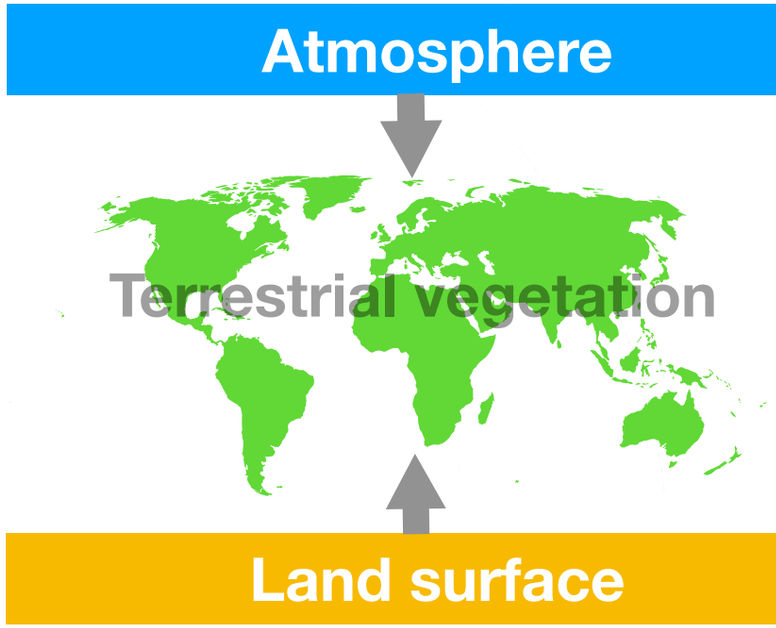
TECHNISCHE UNIVERSITÄT DRESDEN

Which hydro-meteorological variables control large-scale photosynthesis?

Wantong Li, Mirco Migliavacca, Matthias Forkel, Markus Reichstein, Yunpeng Luo and René Orth

Max Planck Institute for Biogeochemistry, Jena, Germany

wantong@bgc-jena.mpg.de



- Both the atmosphere and the land surface influence on the growth of terrestrial vegetation.
- In different regional scales and in climate regimes, which drivers control vegetation growth dominantly? What are the sensitivities of vegetation growth to hydro-meteorological controls?
- Go ahead and find your answers!

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0.Introduction | 1.Data & Methods | 2.1 Results | 2.2 Results | 3. Highlights

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1. Data & Methods

Data

0.5°x0.5° Bimonthly

Vegetation indices
- GOME2 SIF (2007-2018)
- GIMMS 3g NDVI * (1982-2015)

**Due to the aim of shortening the slides, results based on NDVI are not presented. If you are interested, please contact me via email.*

Hydro-meteorological data

ERA5 reanalysis
- Precipitation
- Soil water layer 1 (0-7cm); Soil water layer 2 (7-28 cm)
- Soil water layer 3 (28-100 cm); Soil water layer 4 (100-289 cm)
- Temperature
- Solar radiation
- Vapor pressure deficit (vpd)

Methods

Data processing: Selecting growing season → Removing long-term trends → Removing sparsely vegetated areas

Data analysis
- Identifying the importance of hydro-meteorological variables on vegetation indices
  - → Permutation importance in Random Forest **Code availability in Python*
- Identifying the sensitivities of vegetation indices to hydro-meteorological variables
  - → Partial dependence in Random Forest

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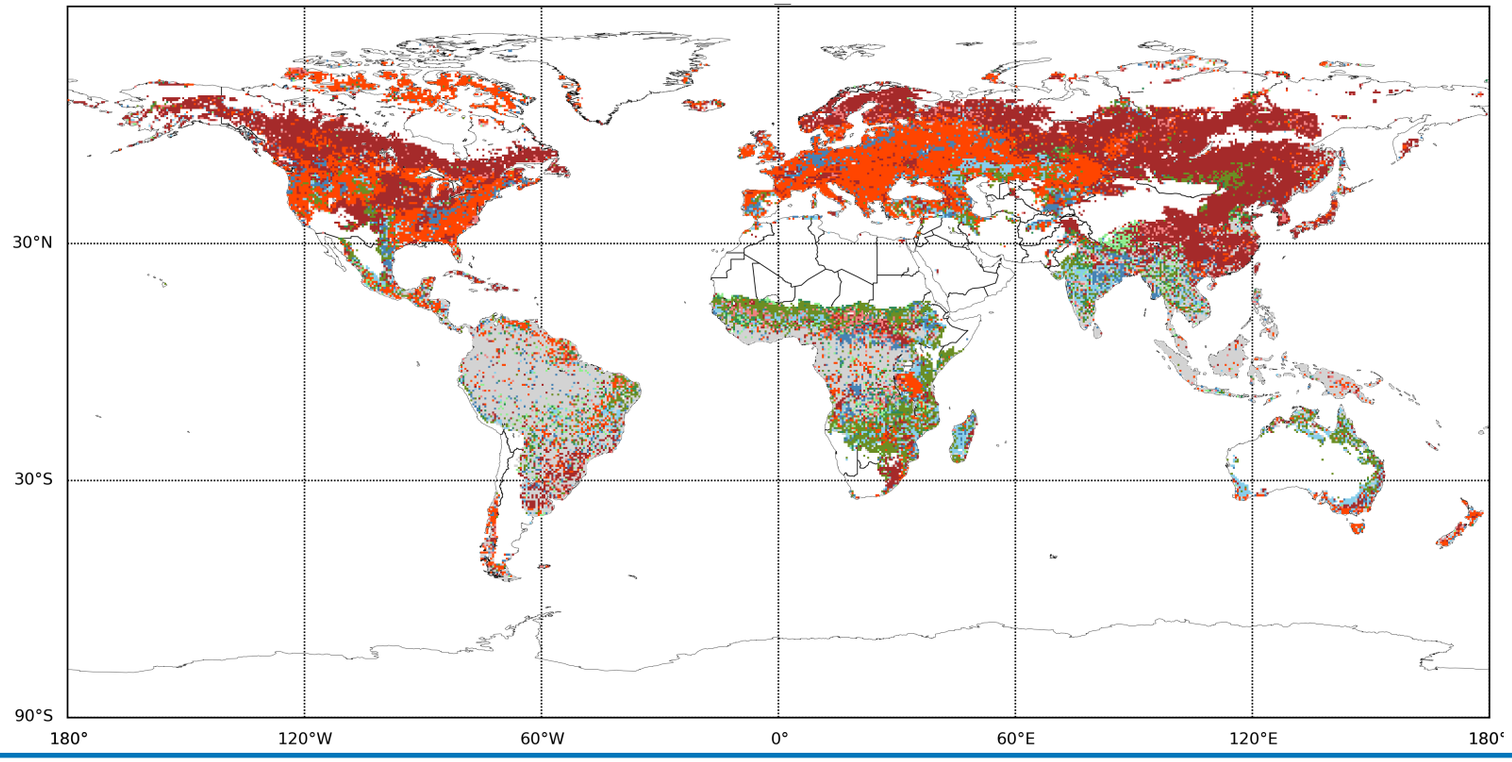
2.1 Results



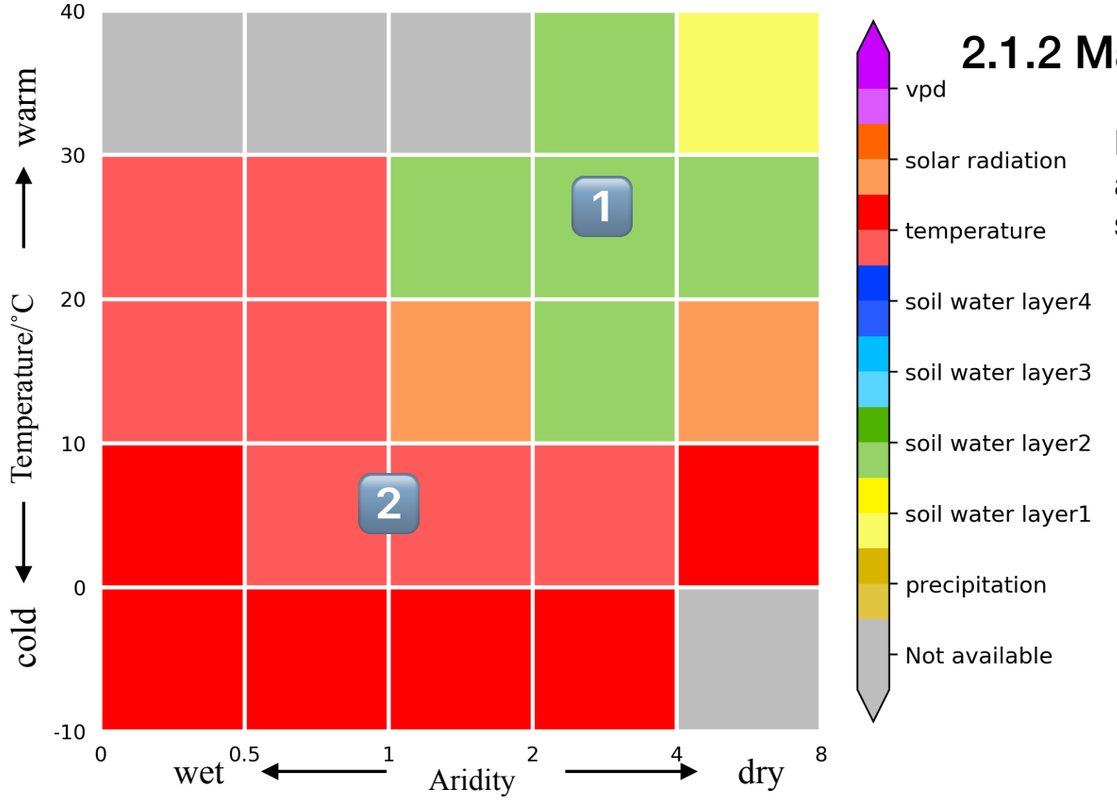
2.1.1 Main hydro-meteorological controls on SIF in a global scale

Notes: Colors present the highest values of importance in Random Forest predictions.

Drivers of SIF clearly vary with regions and latitudes.

Solar radiation and temperature are identified as the dominant controls on SIF in widespread north latitudes.

The second and third layer of soil water are identified as the dominant controls on SIF in semi-arid regions.



2.1.2 Main hydro-meteorological controls on SIF in different climate regimes

Notes: Colors present the highest values of importance by averaging values in different aridity-temperature scales. Dark colors denote large differences between the highest and second highest values, while light colors denote small differences between them.

1 The second layer of soil water is the dominant driver of SIF in the dry condition, while it shows small differences with the third layer of soil water (not shown).

2 Temperature is identified as the main driver of SIF in the wet, or dry but cold conditions, while solar radiation (not shown) tensely follows temperature as the second main driver.

Aridity=potential evapotranspiration/precipitation
(Here we use unit-adjusted net radiation to replace potential evapotranspiration.)

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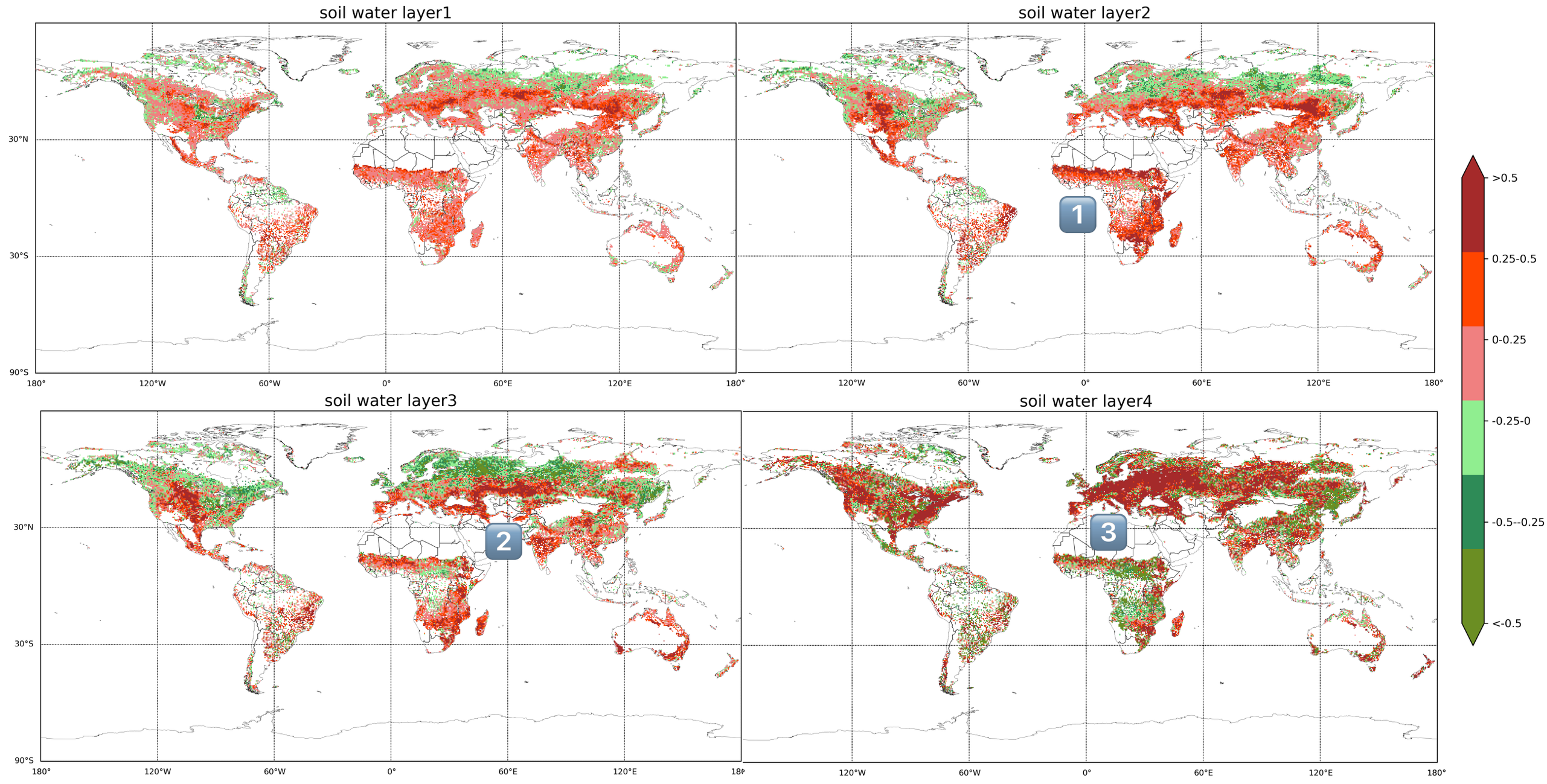
2.2 Results

2.2 The sensitivities of SIF to different layers of soil water



We illustrate diverse extents and patterns in sensitivities of SIF to different layers of soil water.
The second and third layers of soil water, SIF is more sensitive to the second layer of soil water in Sahel and South Africa 1, while SIF is more sensitive to the third layer in middle Eurasia and India. The strongest sensitivity is found in Europe with the sensitivity of SIF to soil water layer 4 3 2

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3. Highlights

- Identifying the importance of hydro-meteorological variables on vegetation indices

  ➡ The second layer of soil water is the main driver of vegetation growth in the dry condition, and it shows small differences with the second dominant driver, the third layer of soil water (not shown).

  ➡ Temperature is the dominant control in wet condition, or in dry but cold condition, and solar radiation (not shown) tensely follows temperature as the second main driver.

- Identifying the sensitivities of vegetation indices to hydro-meteorological variables

  ➡ We detect sensitivities of SIF to different water- and energy- related variables (not shown);

  We highlight diverse extents and patterns in sensitivities of SIF to different layers of soil water.

- Methods discovery (not shown)

  ➡ Distinguishing different layers of soil water can enhance the patterns of soil water-controlling on vegetation growth.

  ➡ Main drivers identified by Random Forest show similar patterns with those identified by correlative methods.

Thank you for your attention!

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