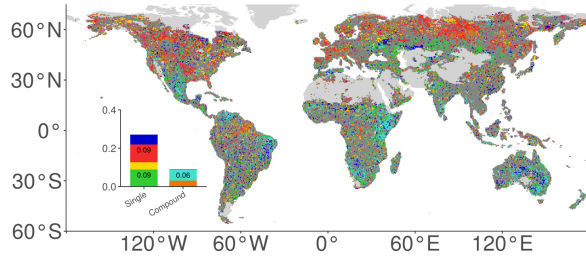Biogeosciences

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Supplement of

Spatially varying relevance of hydrometeorological hazards for vegetation productivity extremes

Josephin Kroll et al.

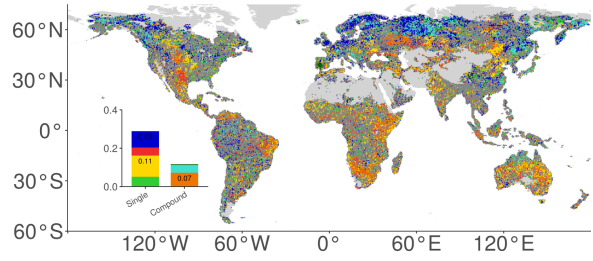*Correspondence to:* Josephin Kroll (jkroll@bgc-jena.mpg.de) and Jasper M. C. Denissen (jdenis@bgc-jena.mpg.de)
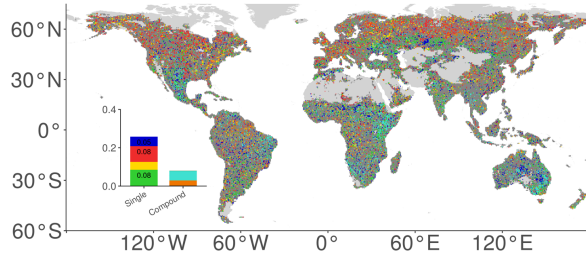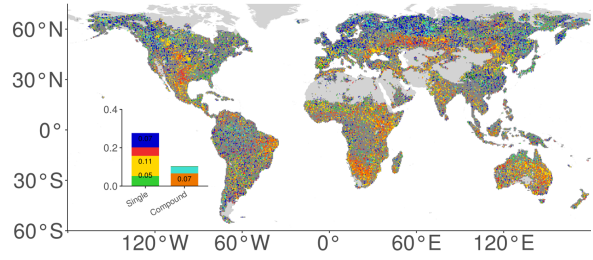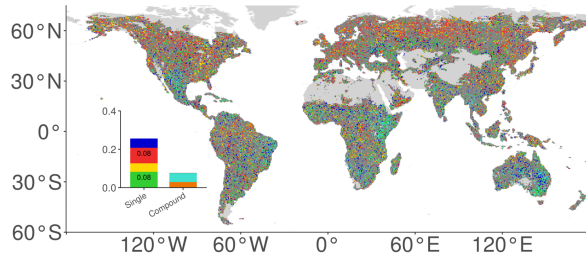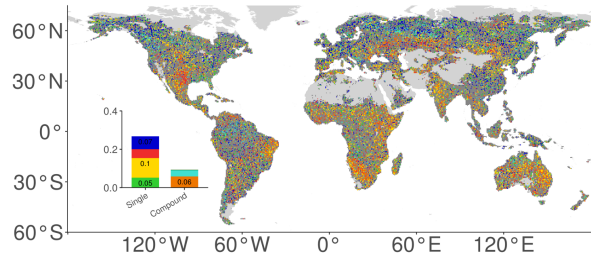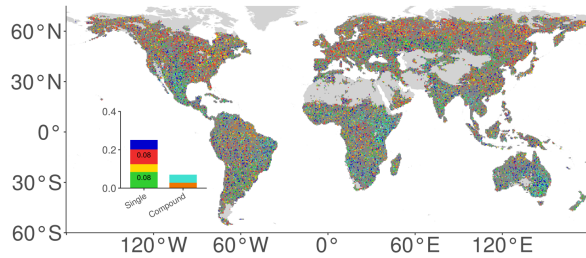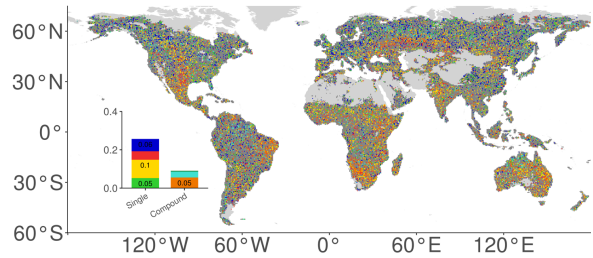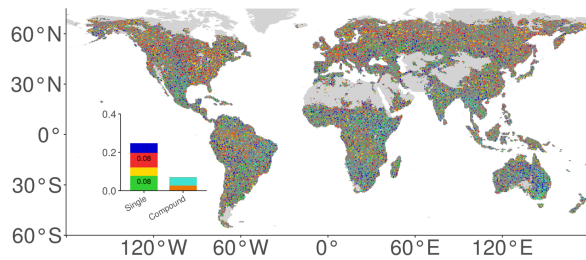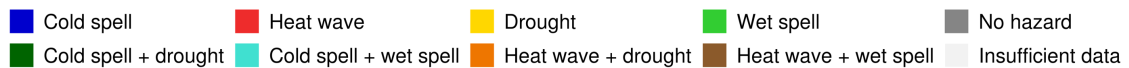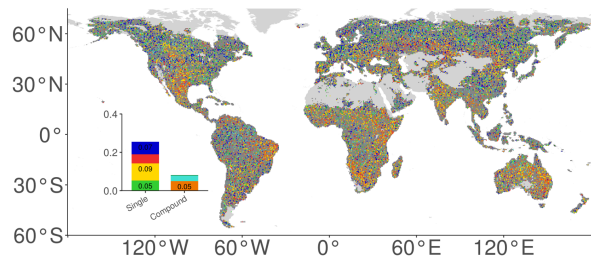
Fig. S1. Hydrometeorological hazards co-occurring with each of the five SIF maxima and minima (1st is the strongest extreme, 5th the weakest one). Temperature and soil moisture anomalies are considered as extreme if they are below/above the 10/90th percentile of 100 randomly sampled temperature and soil moisture anomalies.
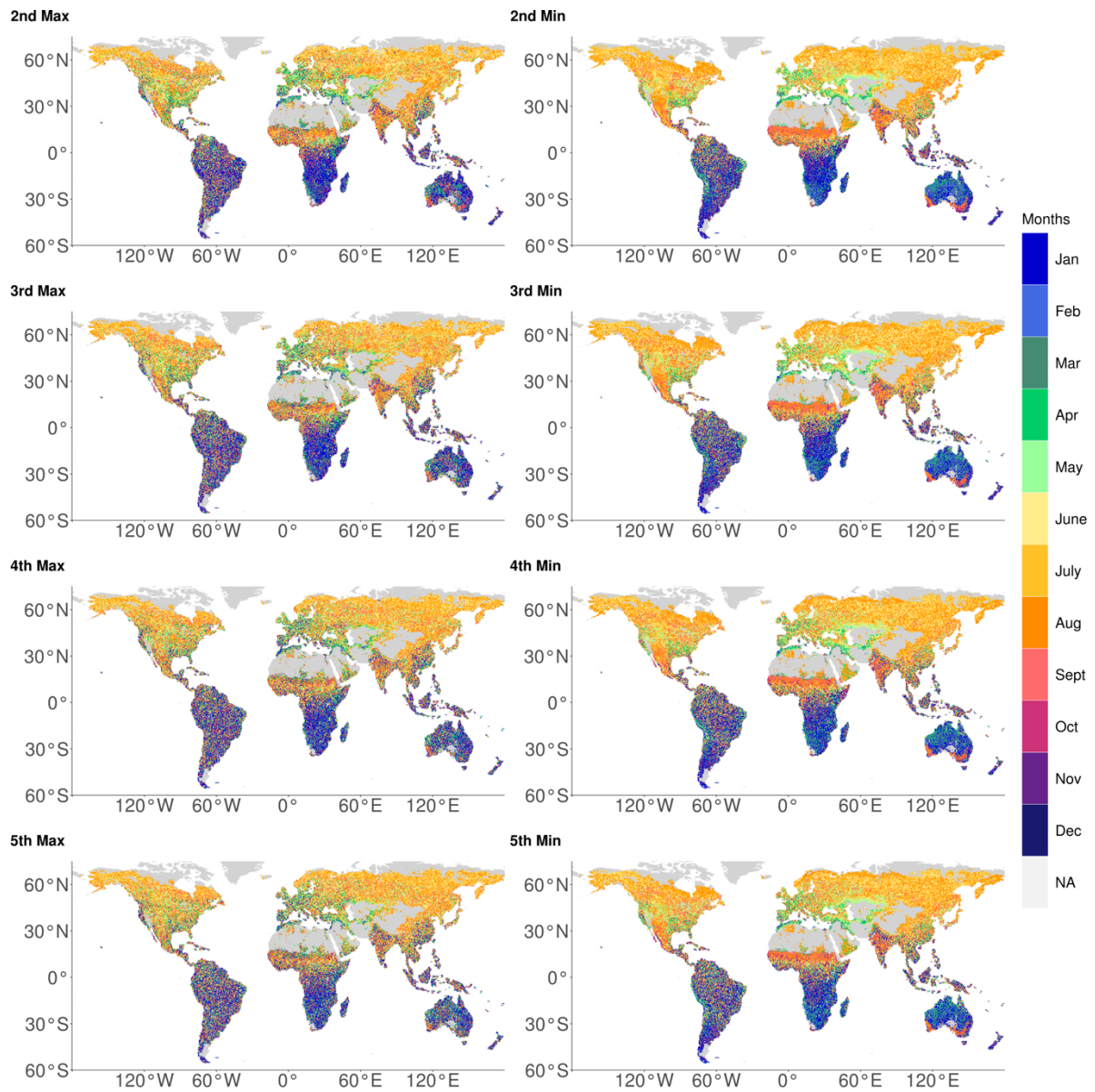
Fig. S2. Global distribution of the month-of-year in which each of the four remaining SIF maxima and minima occurred (2nd is the second strongest extreme, 5th the weakest one).

a) Maximum vegetation productivity

b) Minimum vegetation productivity

Legend:
- Soil moisture layer 1
- Soil moisture layer 2
- Soil moisture layer 3
- Precipitation
- Radiation
- Temperature
- Vapor pressure deficit
- Neg./insign. cor.
- Insufficient data

Fig. S3. Global distribution of hydrometeorological controls (with soil moisture from SoMo.ml) of SIF (a) maxima and (b) minima. The displayed variable correlates strongest with SIF in the extreme months, considering only significant and positive correlations. The bar plot indicates the area controlled by each variable relative to the total land area.

a) Maximum vegetation productivity

b) Minimum vegetation productivity

Legend:
- Soil moisture layer 1
- Soil moisture layer 2
- Soil moisture layer 3
- Soil moisture layer 4
- Precipitation
- Radiation
- Temperature
- Vapor pressure deficit
- Neg./insign. cor.
- Insufficient data

Fig. S4. Global distribution of hydrometeorological controls (ERA5 land) of EVI (a) maxima and (b) minima. The displayed variable correlates strongest with EVI in the extrem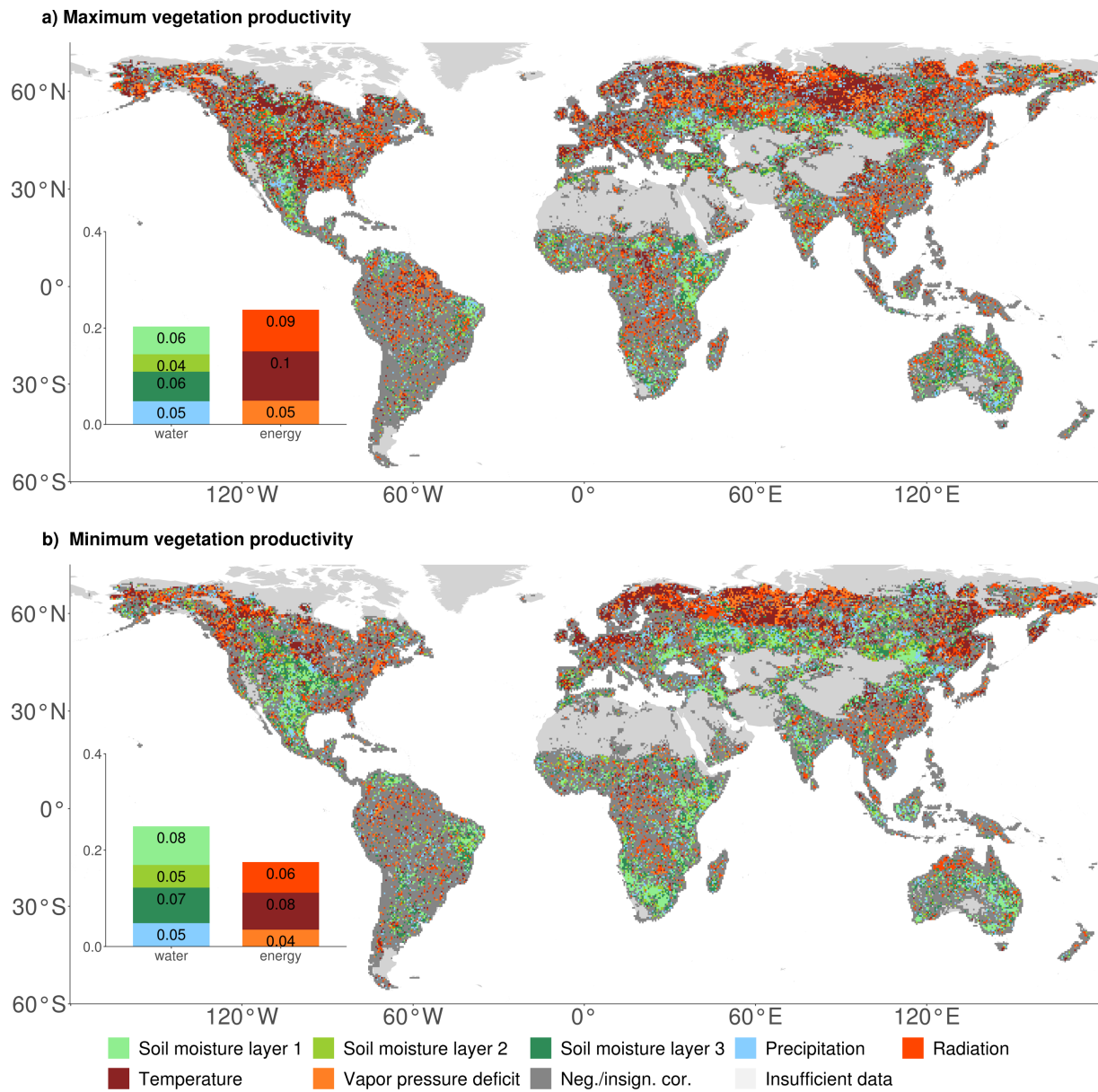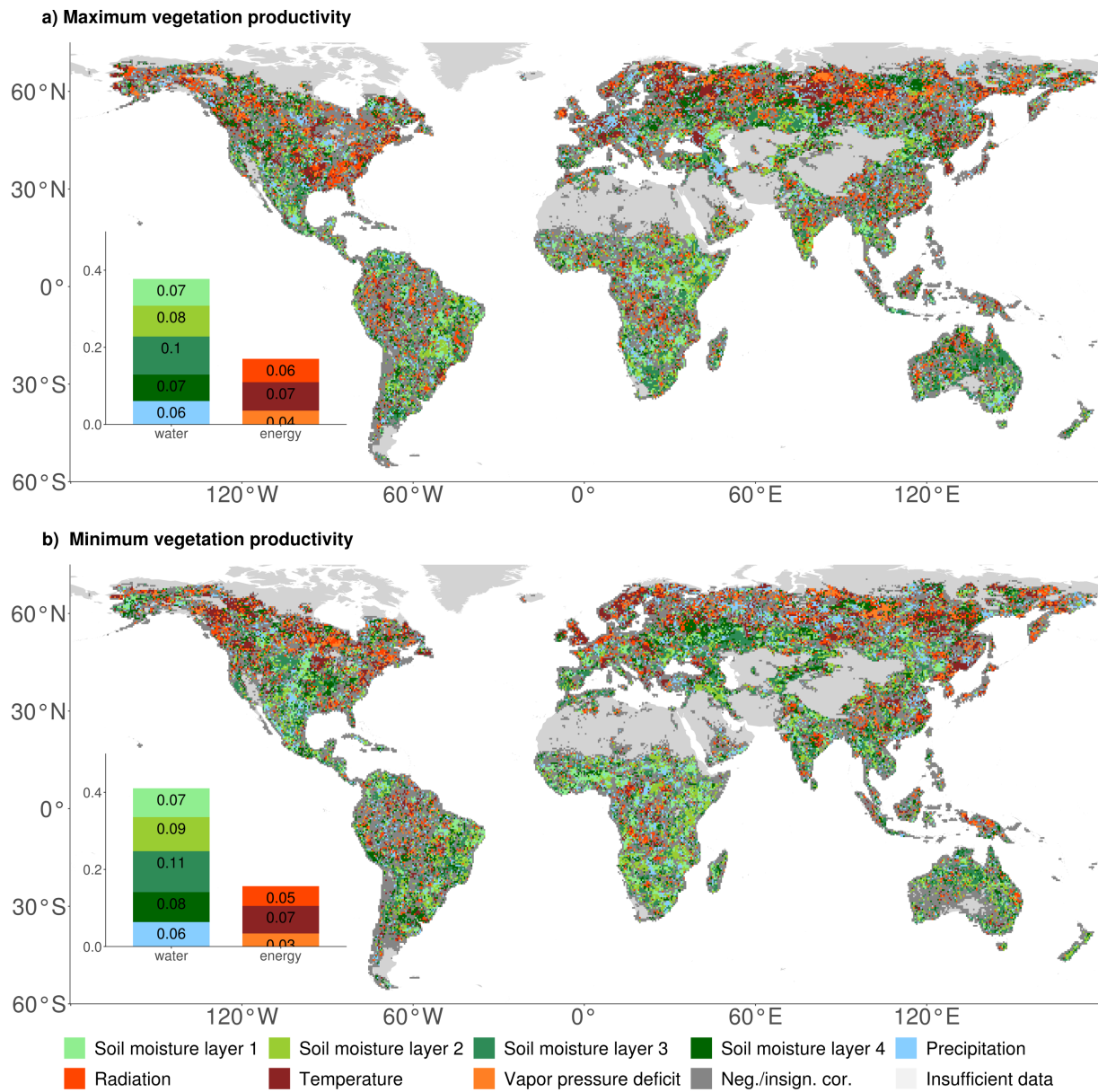e months, considering only significant and positive correlations. The bar plot indicates the area controlled by each variable relative to the total study area.

a) SIF, Maximum

b) SIF, Minimum

Soil moisture layer 1 | Soil moisture layer 2 | Soil moisture layer 3 | Soil moisture layer 4 | Precipitation
Radiation | Temperature | Vapor pressure deficit | Neg./insign. cor. | Insufficient data

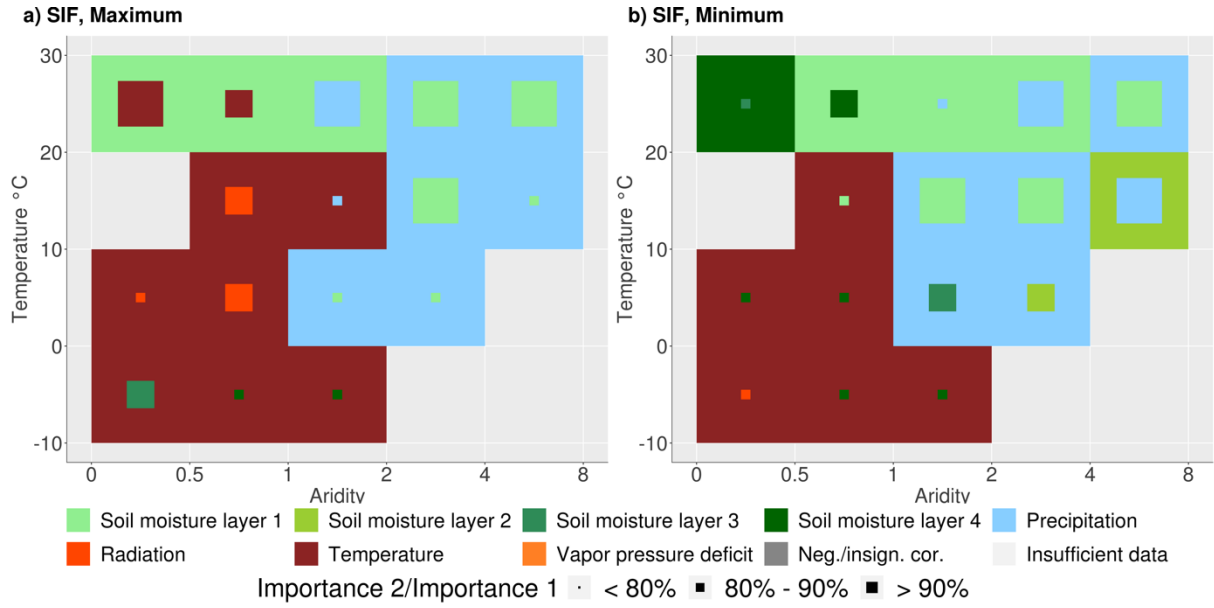Importance 2/Importance 1 · < 80% ▪ 80% - 90% ■ > 90%

Fig. S5. Hydrometeorological controls (ERA5 land) of different climate regimes with a lag time of 1 month. Grid cells are grouped by their long-term temperature and aridity (unit-adjusted net radiation/precipitation). The hydrometeorological variables of the month preceding the SIF extreme have been used in the computation of most important variable. The variable which is important for most of the grid cells for vegetation productivity maxima (a) and minima b), inferred using SIF, in one climate regime is used to color the box. The second most important variable colors the smaller squares. Their ratio is denoted in the size of the squares.

a) ET, Maximum

b) ET, Minimum

Soil moisture layer 1 | Soil moisture layer 2 | Soil moisture layer 3 | Soil moisture layer 4 | Precipitation
Radiation | Temperature | Vapor pressure deficit | Neg./insign. cor. | Insufficient data

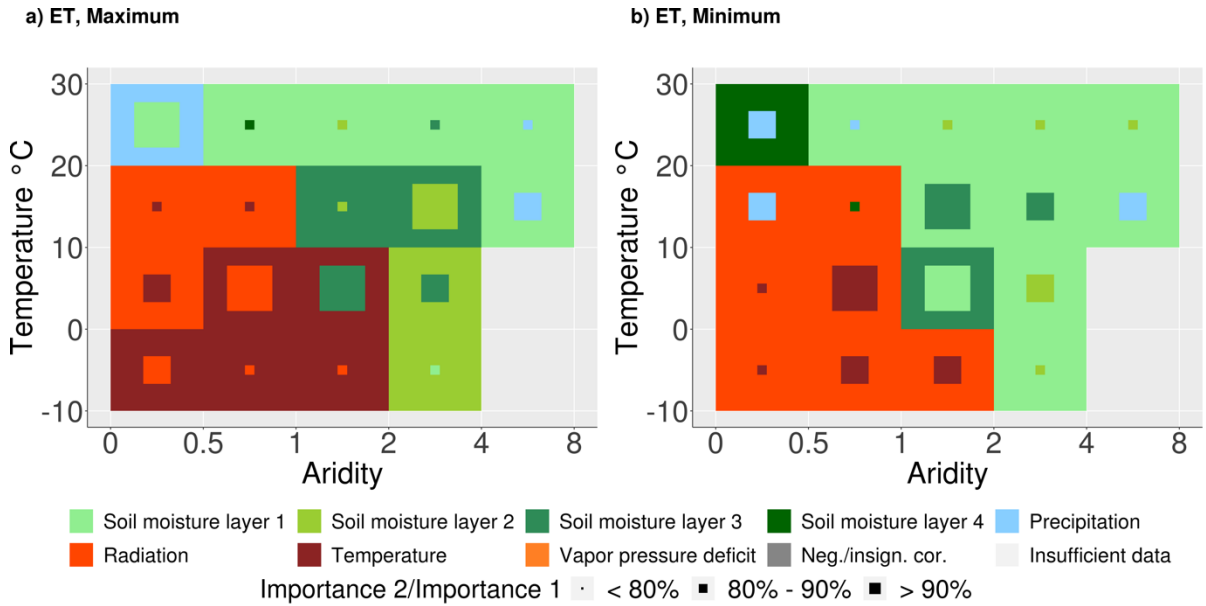Importance 2/Importance 1 · < 80% ▪ 80% - 90% ■ > 90%

Fig. S6. Hydrometeorological controls (ERA5 land) of different climate regimes on ET from GLEAM. Grid cells are grouped by their long-term temperature and aridity (unit-adjusted net radiation/precipitation). The variable which is important for most of the grid cells for vegetation productivity maxima (a) and minima b), inferred using ET, in one climate regime is used to color the box. The second most important variable colors the smaller squares. Their ratio is denoted in the size of the squares.
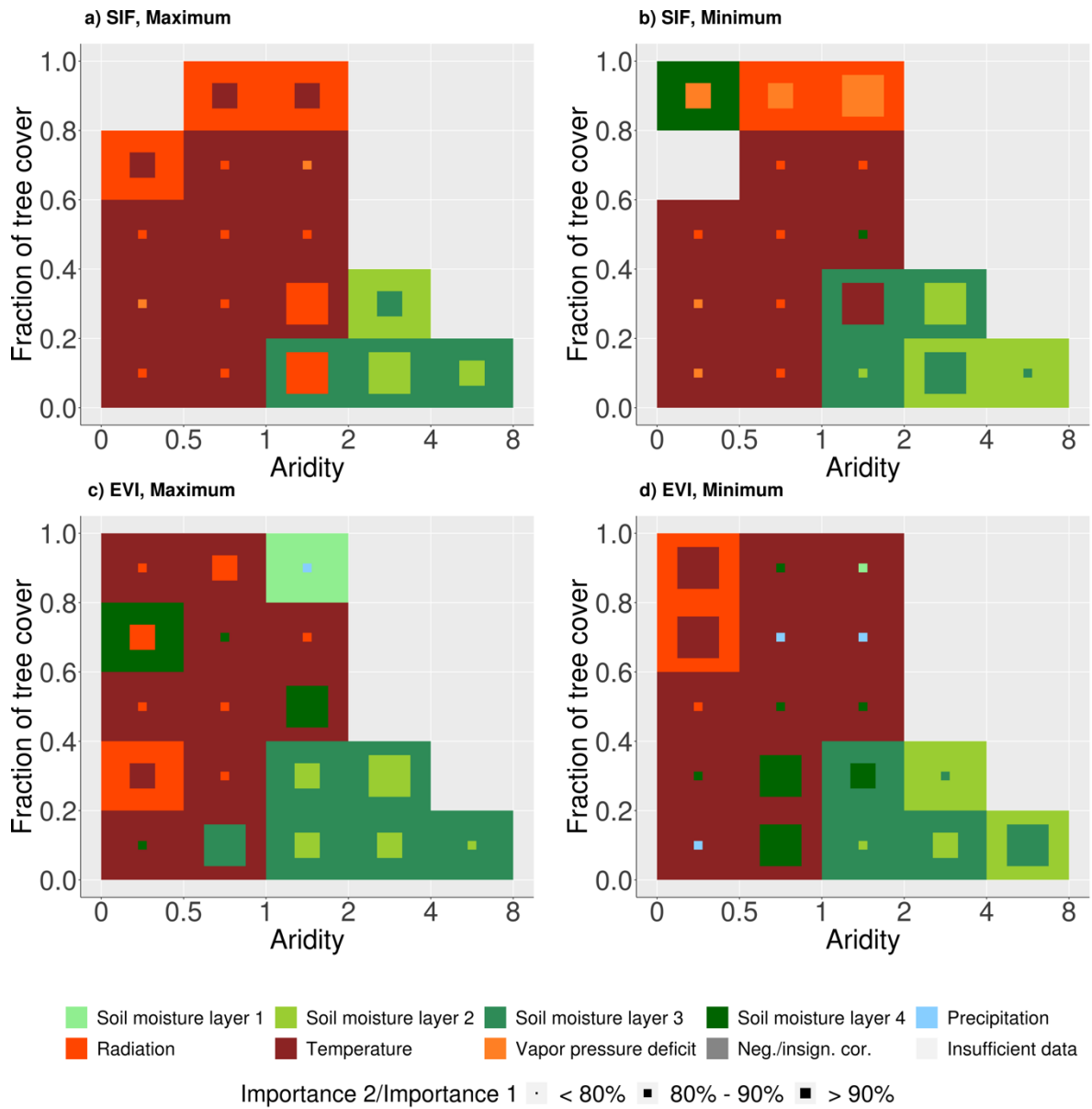
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Fig. S7. Hydrometeorological controls (ERA5 land) of different vegetation regimes. Grid cells are grouped by their fraction of tree cover and aridity (unit-adjusted net radiation/precipitation). The variable which is important for most of the grid cells for vegetation productivity extremes (a) and b) SIF; c) and d) EVI) in one vegetation regime is used to color the box. The second most important variable colors the smaller squares. Their ratio is denoted in the size of the squares.
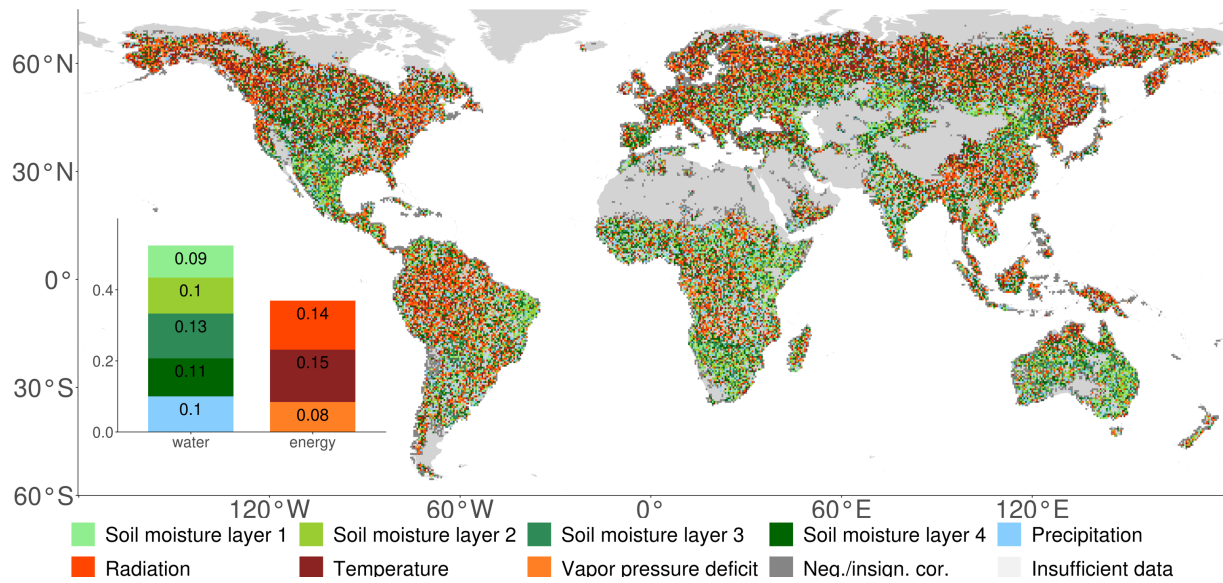
Fig. S8: Global distribution of hydrometeorological controls of non-anomalous SIF. The displayed variable correlates strongest with SIF in 5 randomly chosen months (from 25-75% range of the SIF anomaly distribution), which have a similar variation as the 5 maximum SIF months. Only significant and positive correlations are considered. The bar plot indicates the area controlled by each variable relative to the total study area (which is slightly different here compared with Fig. 4 as non-extreme SIF anomalies with similar variability might not be found in every grid cell).