Precipitation and soil moisture driving terrestrial carbon cycle variability in Europe

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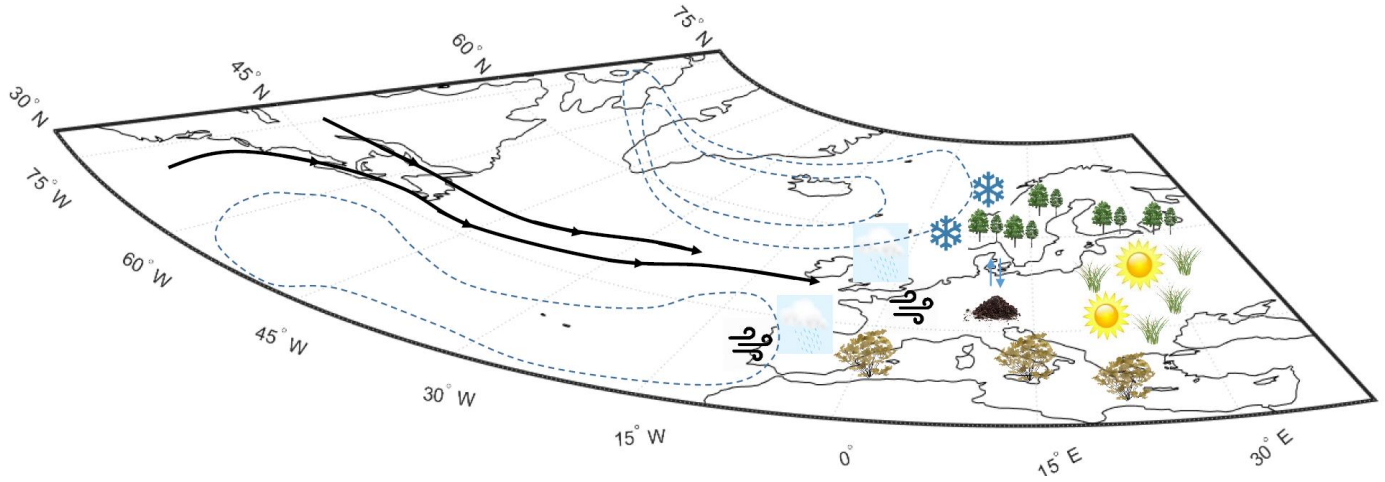
Background

The terrestrial biosphere is **heavily influenced by climate:**

- From sub-daily to paleoclimatic timescales.
- From local to continental and global spatial scales.



Schematised view of how regional weather anomalies can influence the terrestrial carbon cycle.

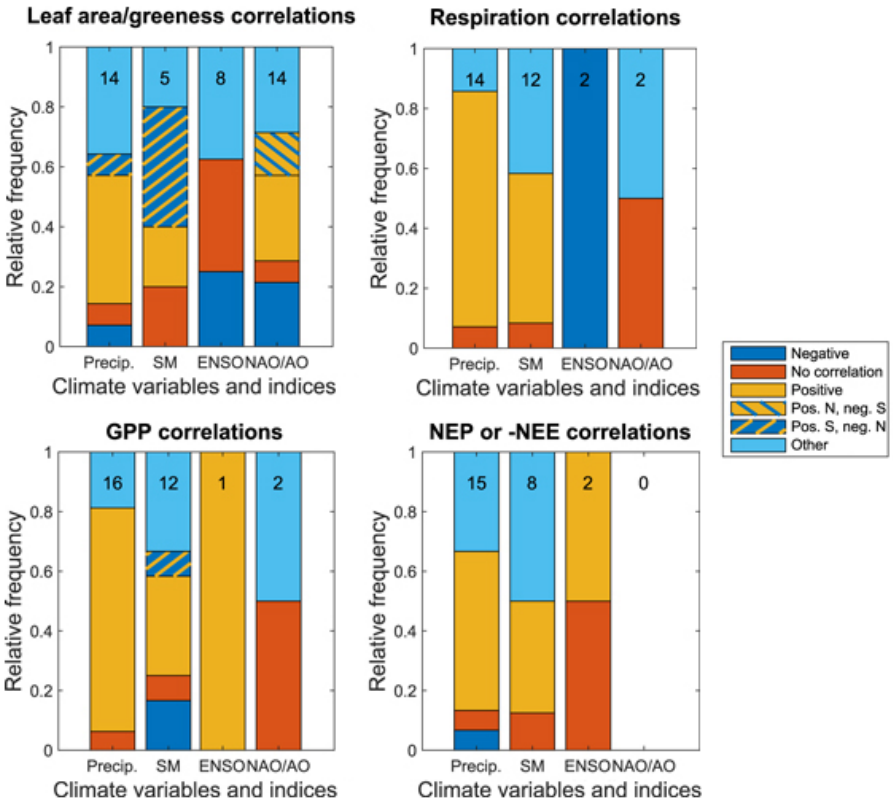
Scientific Question

Can we summarise **areas of (dis)agreement and ongoing research challenges?**

We provide a review of how precipitation, soil moisture and aggregated climate variability indices relate to the variability of the European terrestrial carbon cycle at sub-daily to interannual scales.

A Quantitative Review

Broad agreement for precipitation; more uncertainty for soil moisture and climate indices.



Relative frequencies of correlations between precipitation, soil moisture (SM), El-Niño–Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO/AO) and C-cycle proxies. Correlations that are positive in Northern regions and negative in Southern regions (Pos. N, neg. S) or vice versa (Pos. S, neg. N) are separated from correlations valid over the majority of the study region. Numbers refer to the sample sizes (adapted from Messori *et al.*, 2019).

Outstanding Challenges

We identify some **knowledge gaps and challenges:**

- Little knowledge of (inter)annual timescales (whereby climate conditions in a given year or set of years affect the C-cycle in subsequent years).
- Correlations between climate metrics and greenness proxies emerge as very variable across studies.
- Potentially large intrinsic variability in the response of a given biome, ecosystem, or even plot, to similar climate forcings.

Future Research

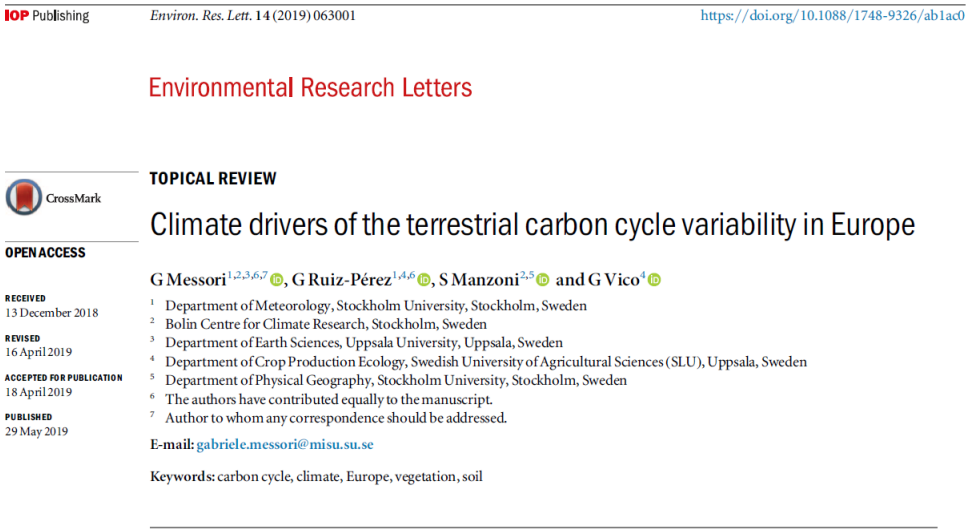
We formulate **future research recommendations:**

- Perform more detailed observational analyses of interannual and longer-term variability.
- Address existing disagreements in the literature, trying to identify whether these result from the methods employed or from complex ecosystem-specific mechanisms.
- Study the roles of: changes in plant phenology and changes in the structure of the climate modes of variability, the latter as a result of both natural low-frequency variability and anthropogenic forcing.

References

For more information and methodological details see our review paper in Environmental Research Letters:

[Climate drivers of the terrestrial carbon cycle variability in Europe]



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TOPICAL REVIEW

Climate drivers of the terrestrial carbon cycle variability in Europe

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