EGU23-14577, updated on 26 Feb 2024
https://doi.org/10.5194/egusphere-egu23-14577
EGU General Assembly 2023

Compound effects of extreme spring temperature fluctuations on vegetation phenology

Guohua Liu[1], Mirco Migliavacca[2], Christian Reimers[1], Ana Bastos[1], Nora Linscheid[1], Markus Reichstein[1], and Alexander J. Winkler[1]

[1]Department of Biogeochemical Integration, Max Planck Institute for Biogeochemistry, 07745 Jena, Germany
[2]European Commission - Joint Research Centre Via Enrico Fermi, 21027 Ispra (VA), Italy

Strong spring temperature anomalies can have major impacts on the phenological development of vegetation throughout the season. In particular, an unusually warm spring can lead to premature plant development, while late-spring frost events can damage plants and result in reduced growth. However, the effects of early-spring warming and late-spring frost events on the seasonal development of vegetation, as well as their compound effect, still need to be investigated. Here, we apply a data-driven phenological model that accounts for meteorological memory to assess the effects of early-spring warming and late-spring frost events on key metrics of the phenological cycle, including the timing of spring green-up, peak greenness and autumn green-down for various vegetation types using ground-based observations of vegetation greenness (PhenoCam network). We find that early-spring warming leads to an advancement of all key metrics, *i.e.*, spring green-up, peak greenness and autumn green-down. Late-spring frost events, on the other hand, delay the entire seasonal cycle of vegetation development. The compound effect of both reveals that early-spring warming can compensate for the adverse impacts of late-spring frost events. Our study suggests that large fluctuations in spring temperature and compound events, which could increase in intensity and frequency in a warming climate, need to be considered when predicting the vegetation phenology under climate change.