A global increase in tree cover extends the growing season length as observed from satellite records

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Background

- Plant phenology are important for understanding the impact of climate change and human management on the biosphere.
- Land surface phenology is the study of plant phenology across large spatial scales estimated by satellite observations.
- Satellite observations (pixels) are often composed of a mixture of vegetation types, having different phenological characteristics.
- Changes in land surface phenology are often interpreted as a result of climate change-induced impacts on the photosynthetic activity of vegetation.
- However, any changes in tree cover presumably impact land surface phenology.

Aim

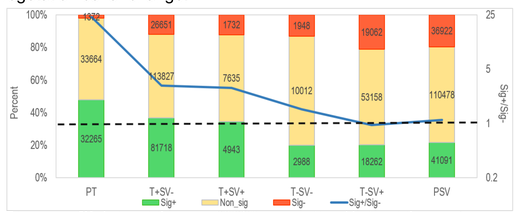
We use a long term Earth observation data (GIMMS 3g V1) to estimate tree cover impacts on land surface phenology (1982–2015).

Data

- **GIMMS NDVI.** Here we use GIMMS NDVI data, available at 1/12 degree spatial resolution, bi-monthly, 1982-2015, to extract land surface phenology (length of season, LOS).
- **VCF data.** Yearly Vegetation Continuous Fields (VCF) data at 0.05 degree was used to extract the changes in tree cover (TC) and short vegetation cover (SV).
- **GenS data.** The Global Environmental Stratification (GEnS) data at 1/12 degree spatial resolution was applied to stratify our results into bioclimatic zones.

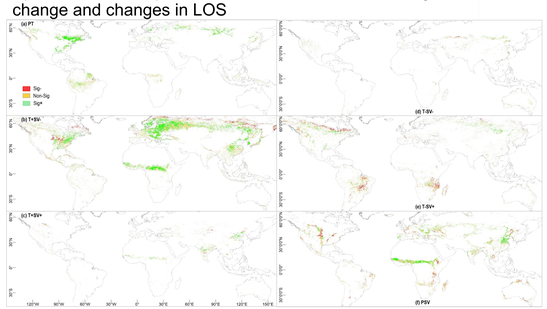
Tree cover impacts on land surface phenology

- We used linear regression ($p<0.1$) to extract the number of each change type of LOS change for the different types of tree cover/short vegetation cover change.

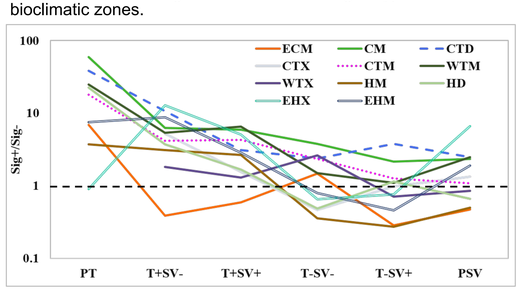


T: tree cover. **SV**: short vegetation cover. **PT(PSV)**: permanent trees/short vegetation.
+/-: significant increasing/decreasing trend

- Spatial relationships between tree cover/short vegetation cover change and changes in LOS

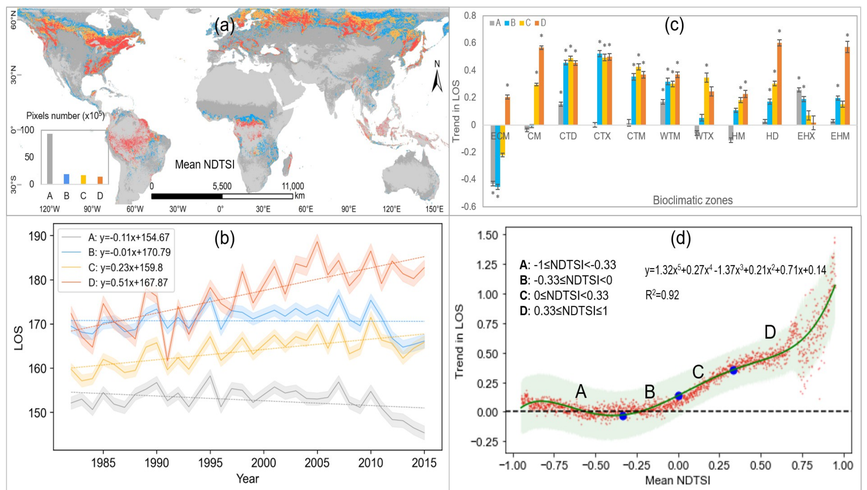


- Changes in the ratio between increasing/decreasing LOS for different tree cover/short vegetation cover change types for different bioclimatic zones.



Impact of tree/short vegetation cover on trends in LOS

- **Impact of tree/short vegetation cover on trends in LOS**



$$NDTSI = \frac{Tree\ cover - Short\ vegetation\ cove}{Tree\ cover + Short\ vegetation\ cove}$$

Type A: -1≤NDTSI<-1/3. Short vegetation cover exceeds tree cover by more than a factor of two.
Type B: -1/3≤NDTSI<0. Mixed species with more short vegetation than trees.
Type C: 0≤NDTSI<1/3. Mixed species with more trees than short vegetation.
Type D: 1/3≤NDTSI≤1. Tree cover exceeds short vegetation cover by more than a factor of two.

Highlights:

- Assessing the role of vegetation cover changes in land surface phenology analysis
- Changes in growing season length are influenced by increasing tree cover globally
- The tree/short vegetation cover ratio affects changes in growing season length
- A re-evaluation of the sensitivity of LSP estimates to climate change is desirable

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