Evaluating the capacity of PlanetScope satellites for fine-scale phenology monitoring across temperate forests in eastern North America

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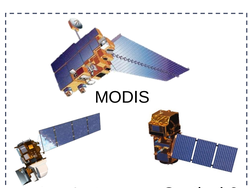
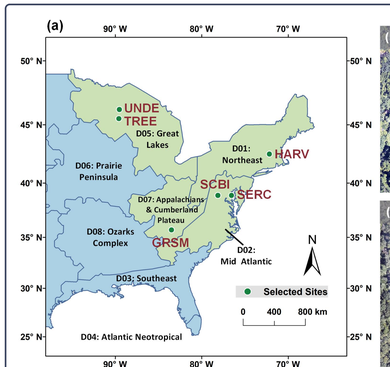
Introduction

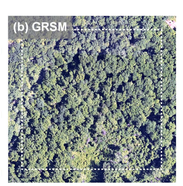
- Leaf phenology is a sensitive indicator of climate change and a major regulator of seasonal carbon and water cycling in temperate forests.
- Large intra-site fine-scale leaf phenology variability is observed by many studies.

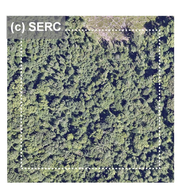


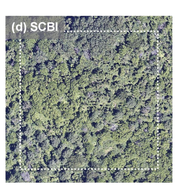
- Field-based observations and proximate remote sensing observations enable fine-scale phenology monitoring but with limited spatial coverage.
- Conventional satellite observations allow for large coverage but limited at ecosystem-scale.
- PlanetScope data with a 3 m spatial resolution probably can observe fine-scale phenology across large spatial coverage, but its capacity has not been assessed.

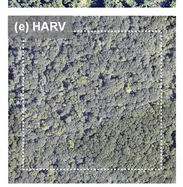
Study sites

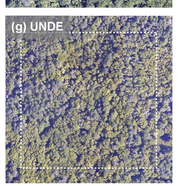






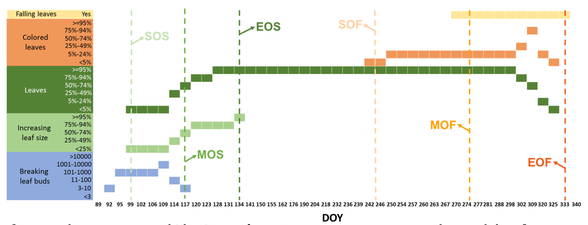




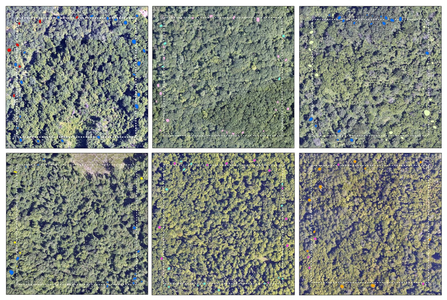


Materials & Methods

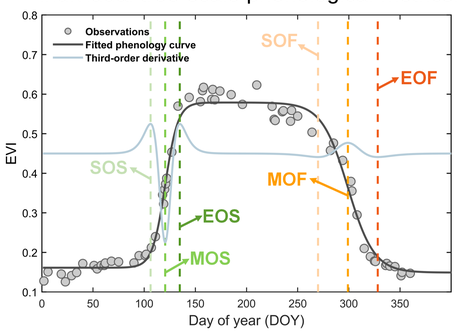
(1) Obtain individual tree-scale phenological metrics from **ground observations**.



(2) Segment individual tree crowns from the **high-resolution airborne imagery**.



(3) Overlap tree crown masks with **time-series PlanetScope data** and extract individual tree-scale phenological metrics.

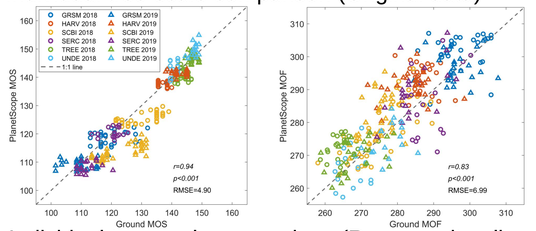


SOS: start of spring
MOS: middle of spring
EOS: end of spring
SOF: start of fall
MOF: middle of fall
EOF: end of fall

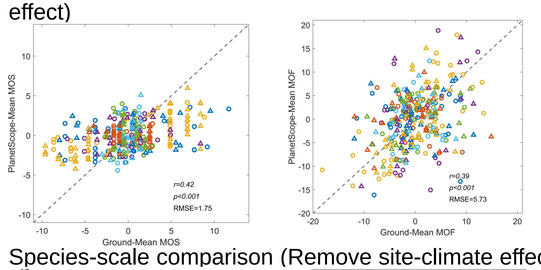
(4) Compare PlanetScope-derived individual tree-scale and species-scale phenological metrics with ground observations.

Results

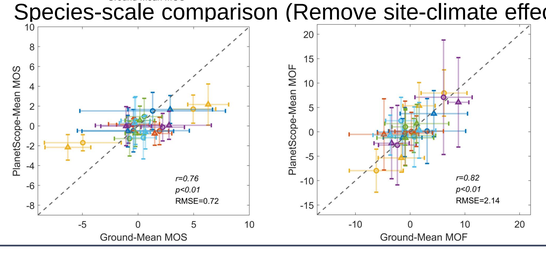
- Individual tree-scale comparison (Original data)



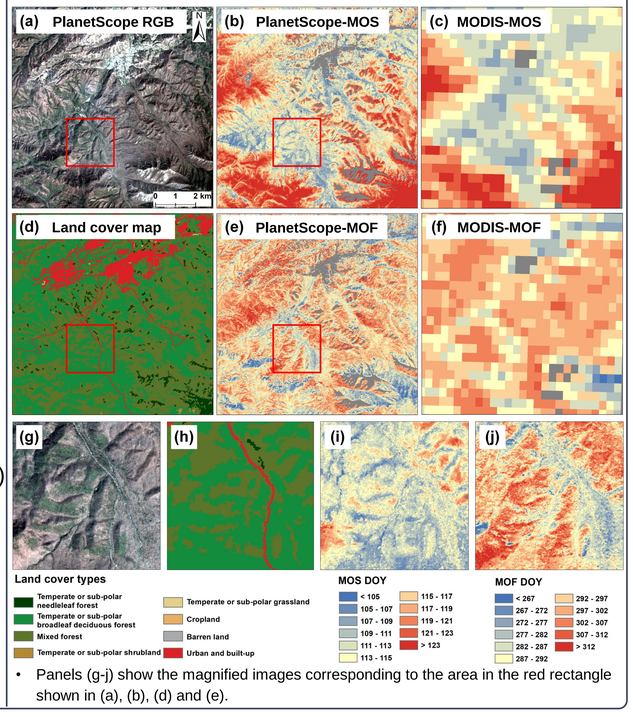
- Individual tree-scale comparison (Remove site-climate effect)



- Species-scale comparison (Remove site-climate effect)



- Maps of spatial variability in phenology derived from PlanetScope and MODIS data (GRSM site)



- Panels (g-j) show the magnified images corresponding to the area in the red rectangle shown in (a), (b), (d) and (e).

Summary

- PlanetScope-derived fine-scale phenology overall displays a good agreement with ground observations, with higher accuracy at the species scale.
- PlanetScope-derived spring phenology has a more consistent trend with ground observations than fall phenology.
- PlanetScope captures a higher fraction of fall phenology variations relative to spring phenology.
- PlanetScope is efficient in characterizing fine-scale phenology variability with spatially explicit information.

Sharing is encouraged

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EGU23-4224

Please refer to Zhao,et al., 2022, RSE, https://doi.org/10.1016/j.rse.2022.113310 for more information.