Constraining JULES phenology using MODIS data - an evaluation at multiple FLUXNET sites

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Can satellite phenology improve C flux estimates?

Importance of phenology

- Realistic representation important in GCMs
- Strongly connected to biosphere-atmosphere exchange
- Affect timing, phase and magnitude of Net Ecosystem Exchange (NEE) of CO_2 between land and atmosphere
- Leaf Area Index (LAI) is key biophysical variable

JULES Phenology

(a) Morgan Monroe State Forest

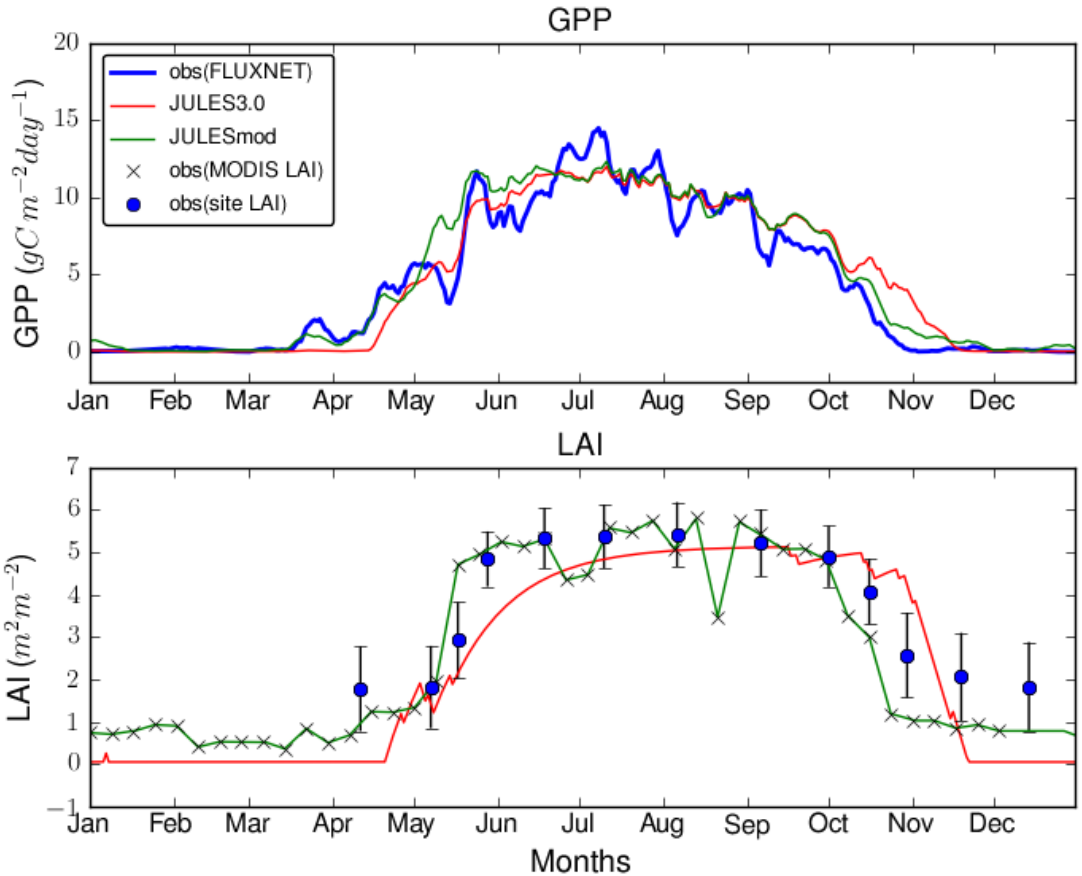
(b) Harvard Forest

Leaf Area Index

- MODIS Collection 5 LAI (MOD15A2)
- MODIS LAI first taken in late Feb. 2000
- Data covers 7x7 km of field site
- Obs every 8 days

Harvard Forest

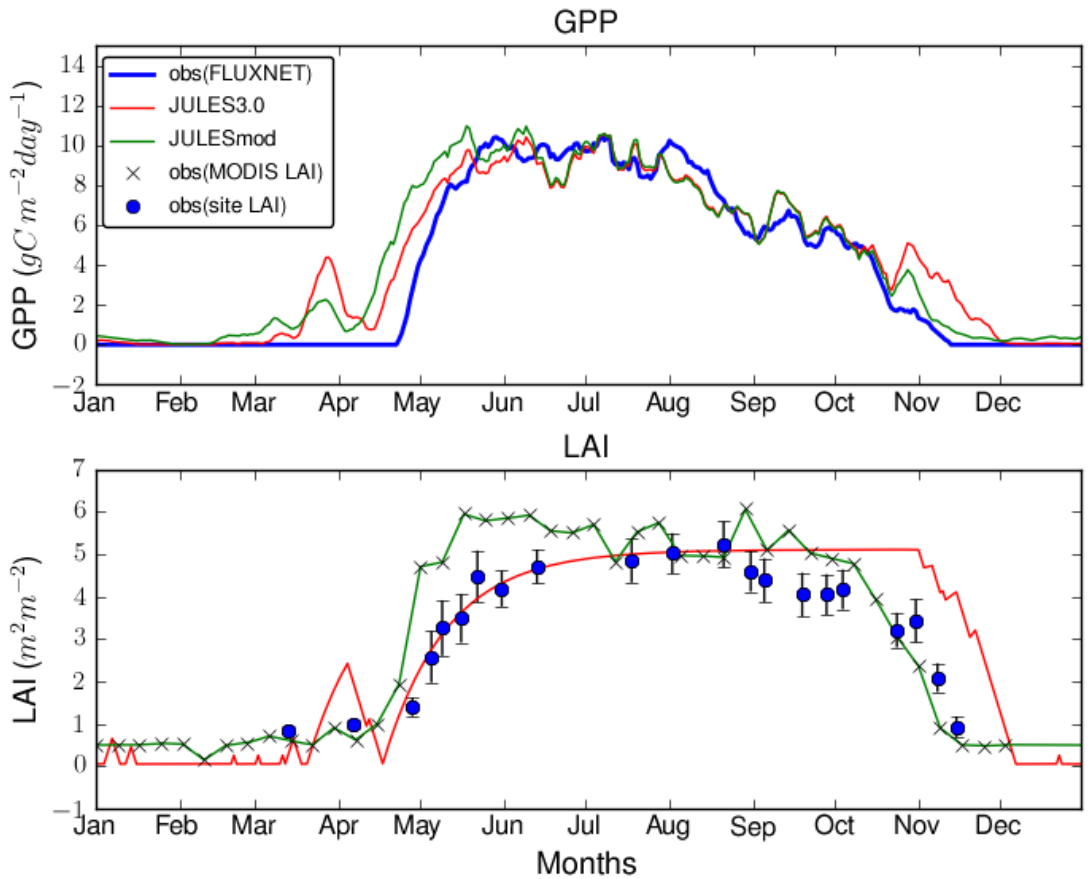
- Deciduous broadleaf forest
- Climate: Temperate



Model captures timing of budburst and phenology (with MODIS LAI) quite well.

Morgan Monroe

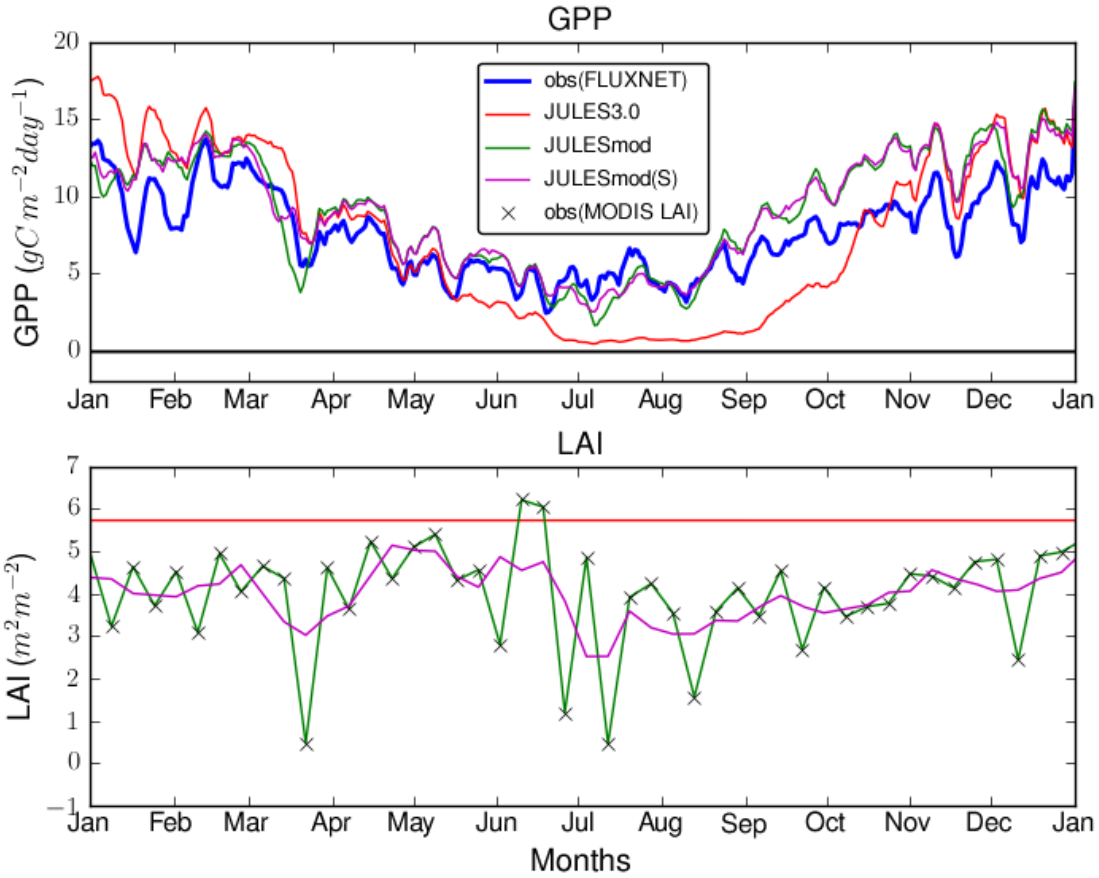
- Deciduous broadleaf forest
- Climate: Temperate



MODIS LAI underestimated, maybe due to atmospheric conditions.

Tumbarumba

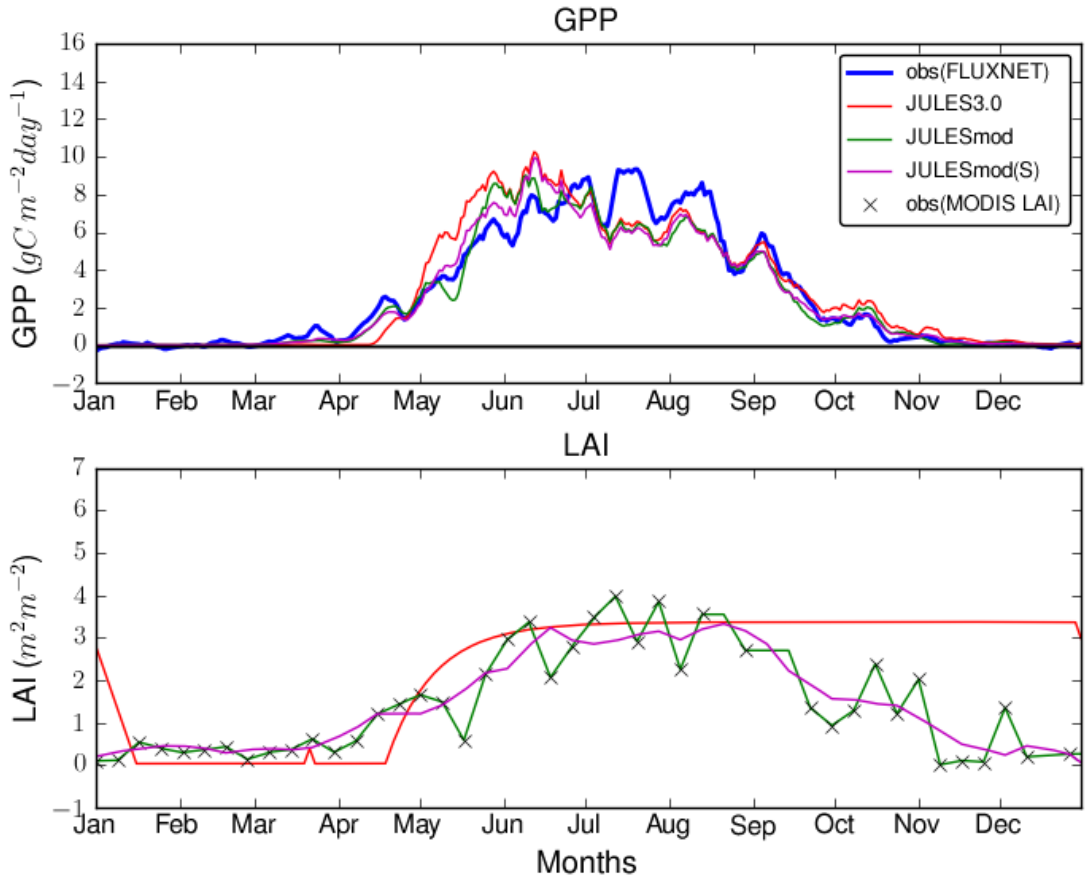
- Wet temperate sclerophyll (New South Wales)
- LAI ~2.5 at ground-level



MODIS LAI overestimated and noisy.

Hyytiala

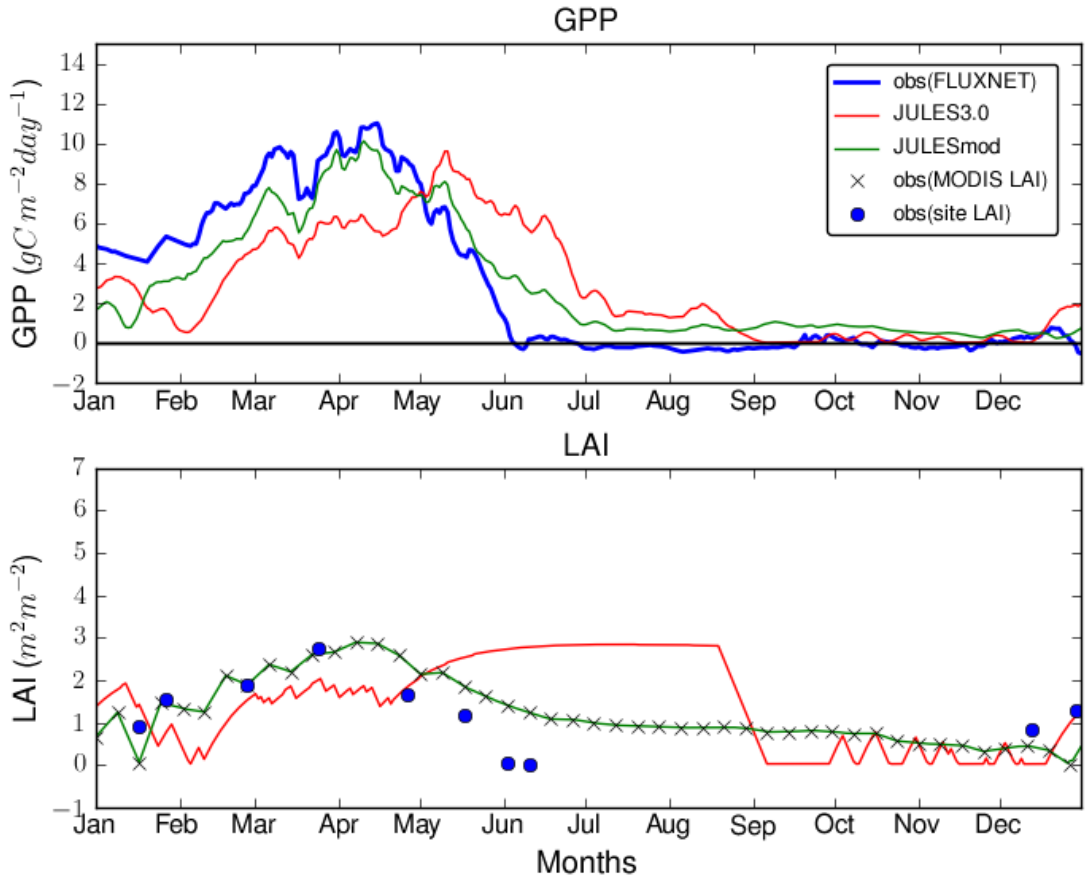
- Evergreen Needleleaf Forest
- LAI ~2.62 at ground-level



Problem with end of season phenology.

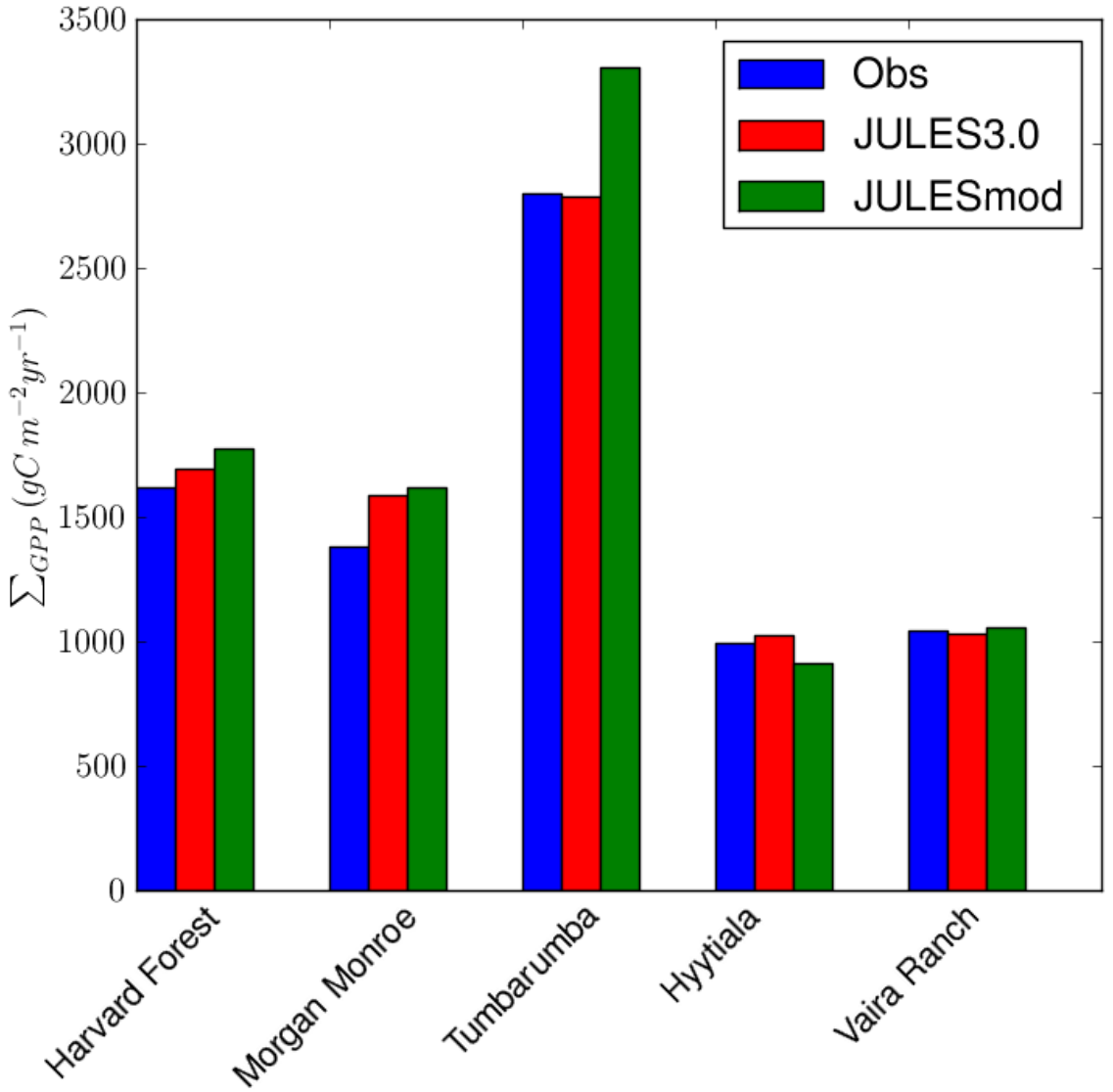
Vaira Ranch

- Grassland (California)
- Climate: Mediterranean



MODIS LAI improves GPP.

Annual GPP


3500
3000
2500
2000
1500
1000
500
0
$\sum_{GPP}(gC\,m^{-2}yr^{-1})$
Obs
JULES3.0
JULESmod
Harvard Forest
Morgan Monroe
Tumbarumba
Hyytiala
Vaira Ranch

Conclusions

- Slight improvements in GPP
- Depends on quality of MODIS data
- Improves beginning/end of growing season
- Model gets it right when using maximum MODIS LAI