Photosynthesis - Solar Induced Fluorescence relationships in polar ecosystems

Kadmiel Maseyk

The Open University, UK

@kmaseyk

Holly Croft, University of Sheffield, UK

Cheryl Rogers, University of Toronto, Canada

Terenzio Zenone, University of Exeter, UK

Walter Oechel, San Diego State University, USA

Donatella Zona, San Diego State University, USA

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

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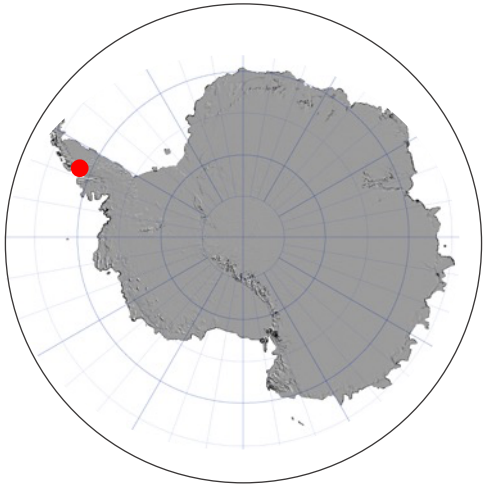
Summary

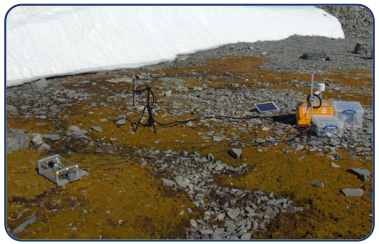
- Short campaigns of ground-based SIF measurements were made in a range of high latitude ecosystems (Antarctic and Arctic)
- Measurements were coupled with photosynthesis measured at different scales (surface chamber, LI6400 leaf, eddy covariance)
- SIF shows linear responses to PAR – variable between ecosystems but also some commonality
- SIF captures short-term temporal dynamics of photosynthesis across scales, but needs to incorporate species and environmental data for quantification

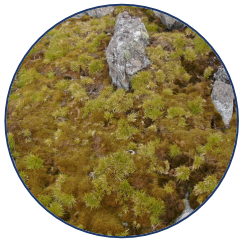
Measurement sites

- Ryder Bay, Antarctic Peninsular
- Abisko, north Sweden
- Utqiaġvik (Barrow), Alaska



Vegetation





Antarctica:
moss beds, and moss with
Deschampsia antarctica

Abisko:
Stordalen Bog –
cloudberry (*Rubus*)
cranberry (*Vaccinium*)

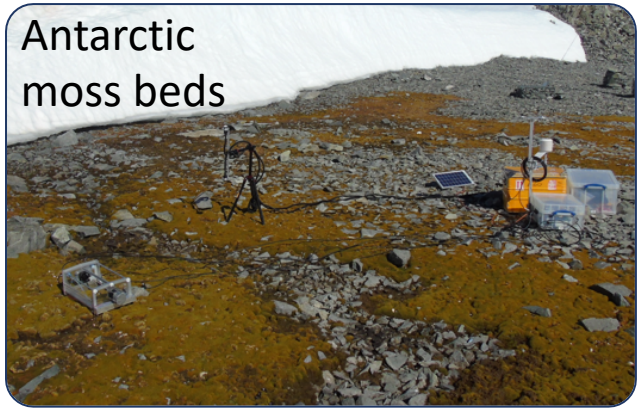
Research Station –
Salix shrub

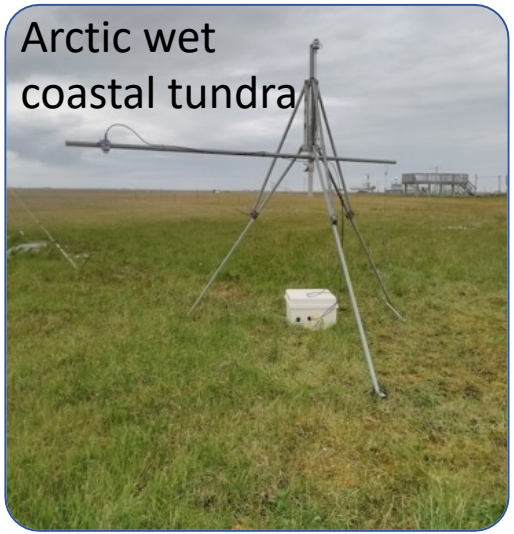
Utqiaġvik:
wet coastal tundra

SIF measurements

Dual-field-of-view spectrometry – Piccolo Doppio

(Mac Arthur et al. 2014)



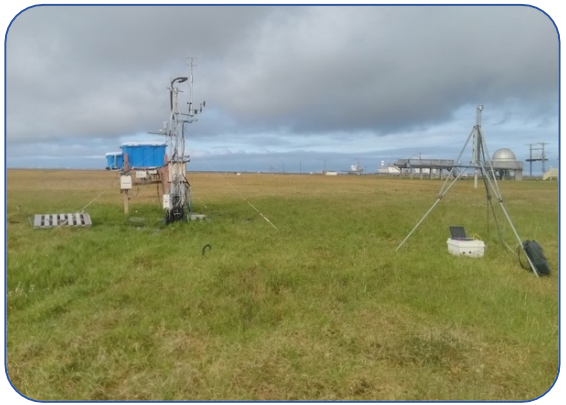


Photosynthesis measurements

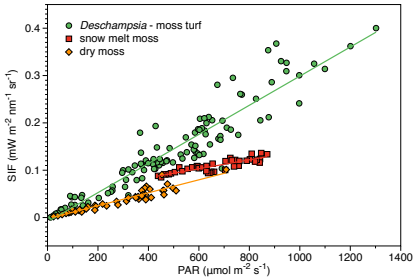
Antarctic moss beds
surface chamber

Arctic shrub and bog
LI6400 leaf phs

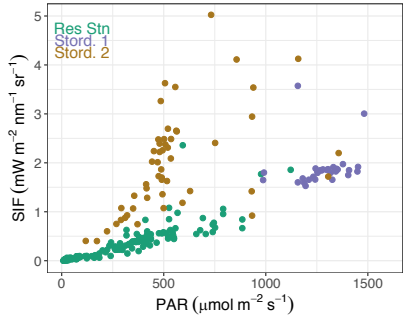
Arctic wet coastal tundra
Eddy covariance



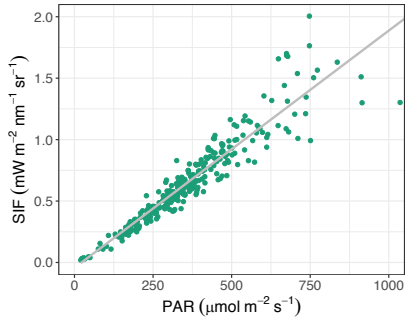
Relationships with PAR



Antarctic moss beds: Increasing SIF with increasing activity and biomass, even dry moss produces some SIF but overall low SIF values



Arctic bog and shrub: *Salix* (Res Stn) and *Vaccinium* (Stord.1) on a similar relationship, *Rubus* (Stord.2) more noisy and higher SIF values



Arctic coastal tundra: Stable relationship over time, similar relationship to *Salix* + *Vaccinium*

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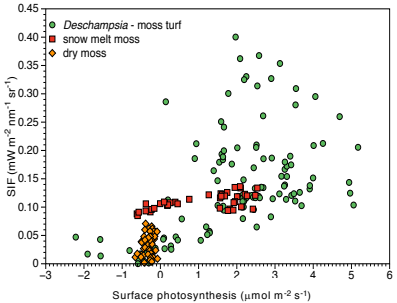
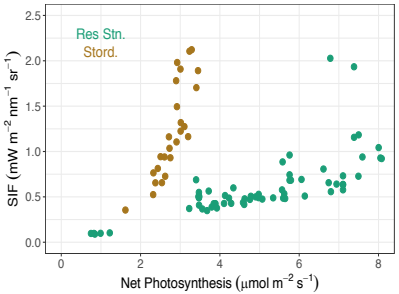
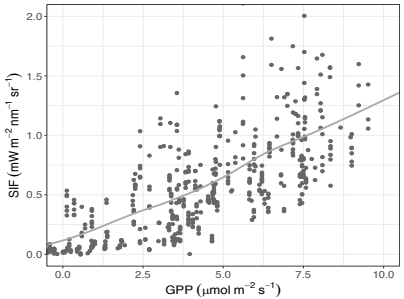
Relationships with Photosynthesis



Antarctic moss beds: SIF quite variable for given photosynthesis in the mixed community



Arctic bog and shrub: Similar divergence between *Salix* and *Rubus,* due to different phs - light responses



Arctic coastal tundra: Lot of variability in the GPP-SIF relationship, indicating role of other factors, but scale similar to *Salix* for LAI = 1

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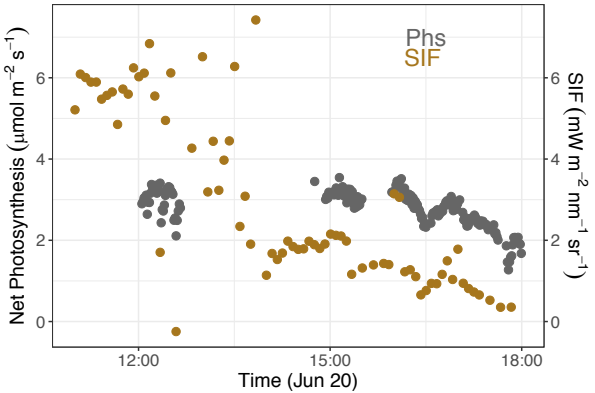
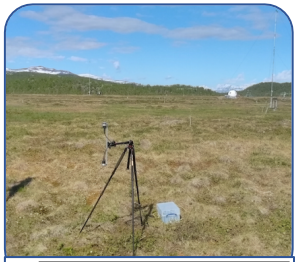
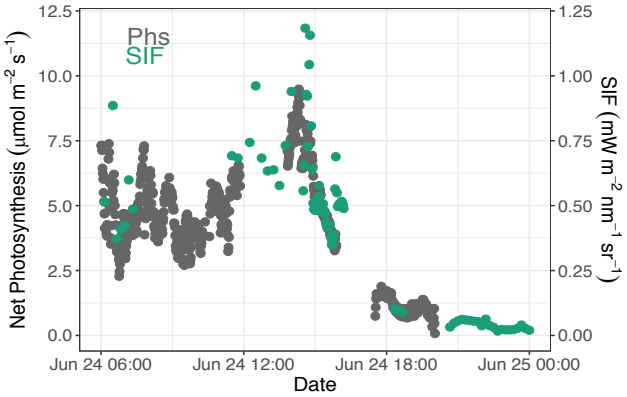
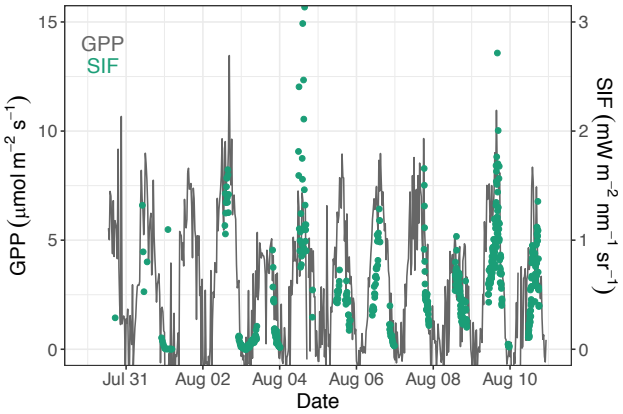
Capturing temporal dynamics









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