Remotely Sensing Crop Stress in the U.S. Corn Belt

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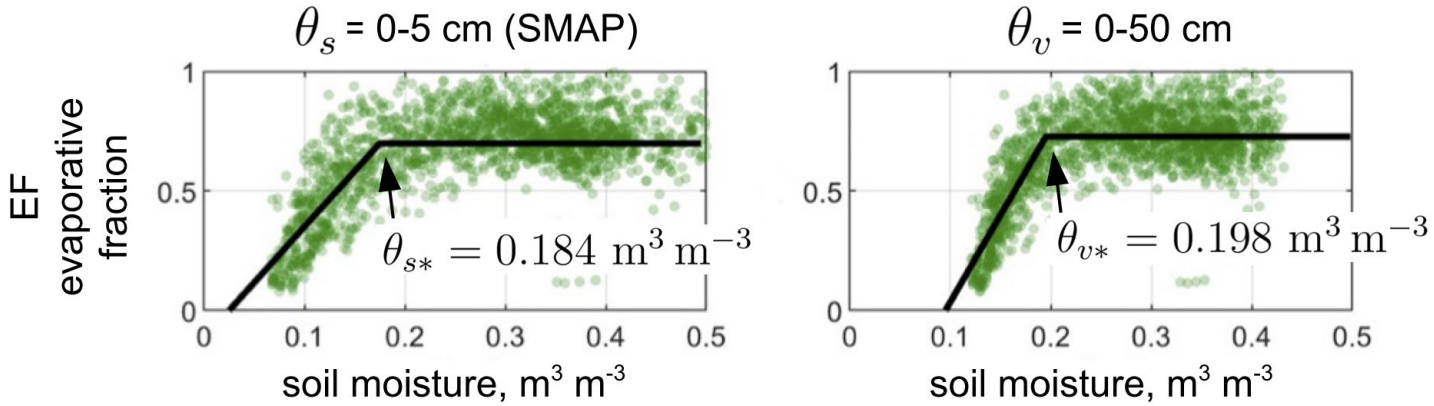
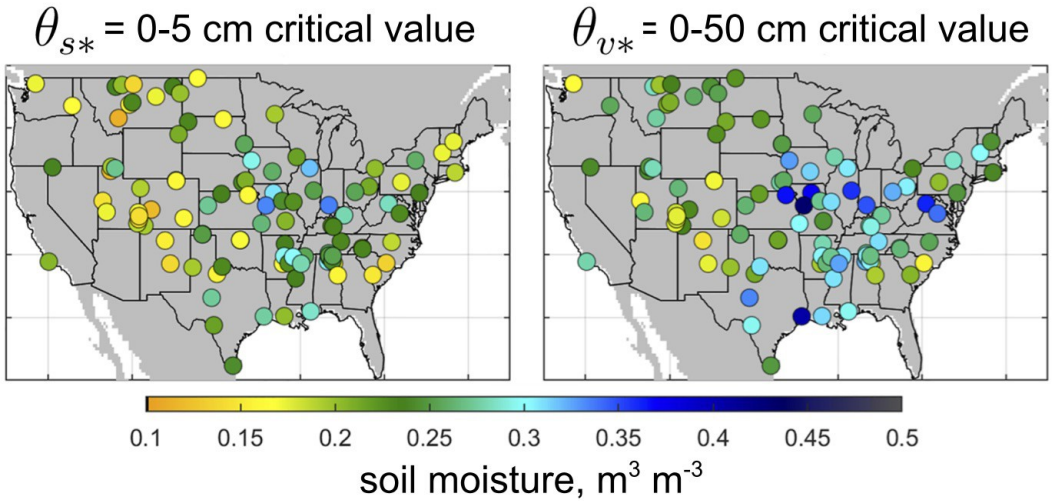
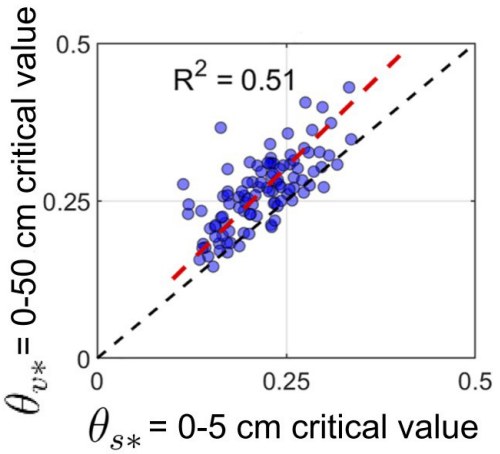
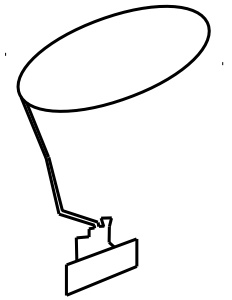
Hornbuckle et al., U.S. Corn Belt Crop Stress









Dong et al. (2022) claim that SMAP can be used to estimate EF because surface and root zone soil moisture are hydraulically linked.

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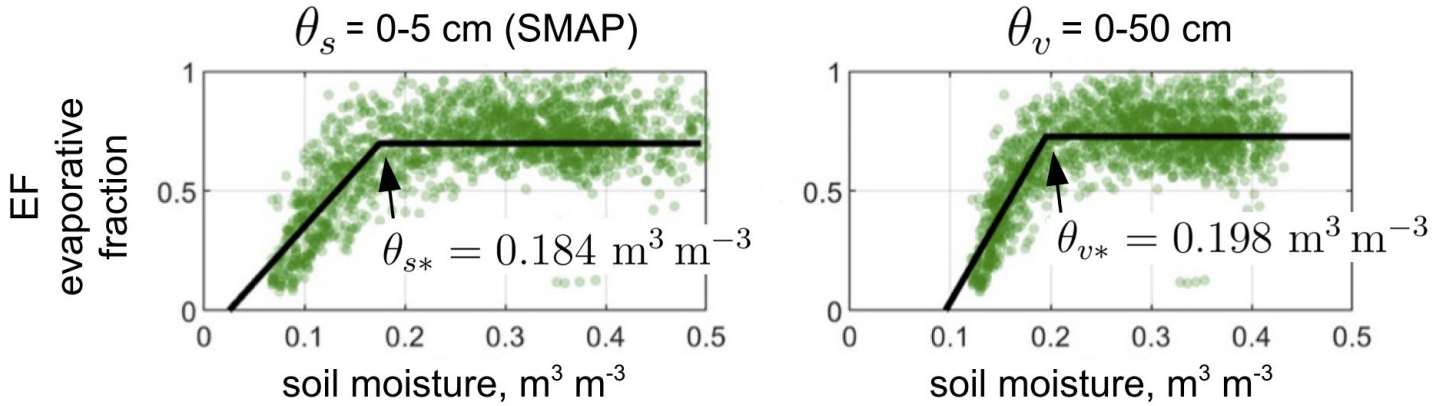
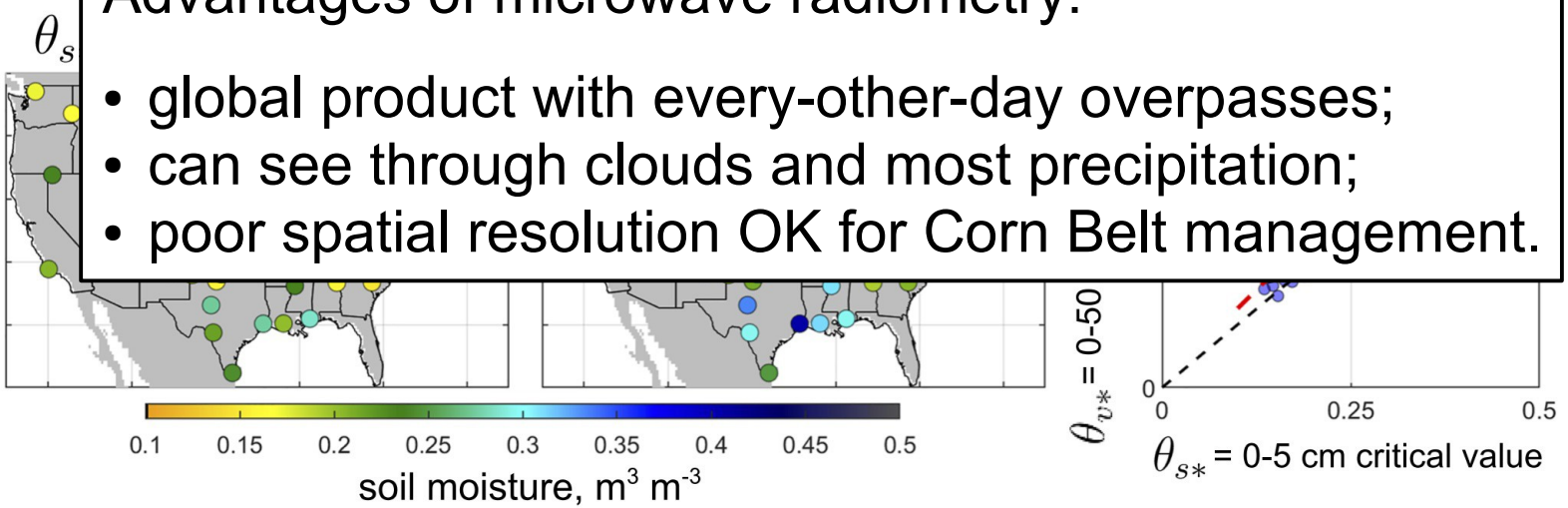
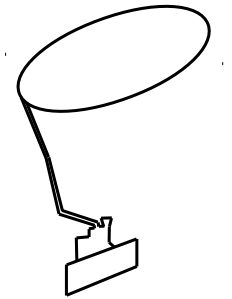


Advantages of microwave radiometry:

- global product with every-other-day overpasses;
- can see through clouds and most precipitation;
- poor spatial resolution OK for Corn Belt management.





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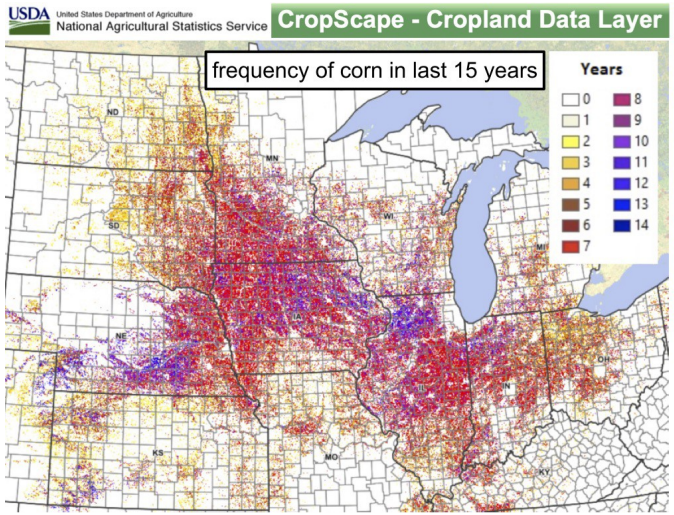
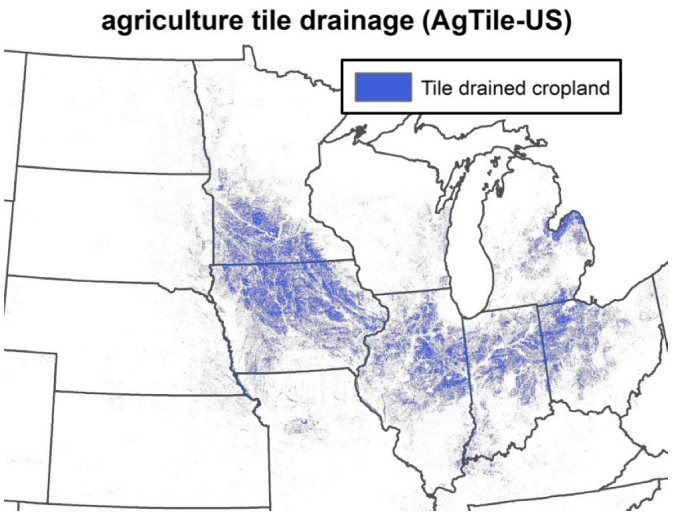




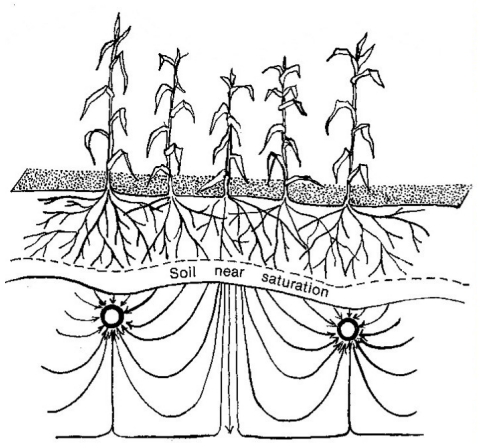
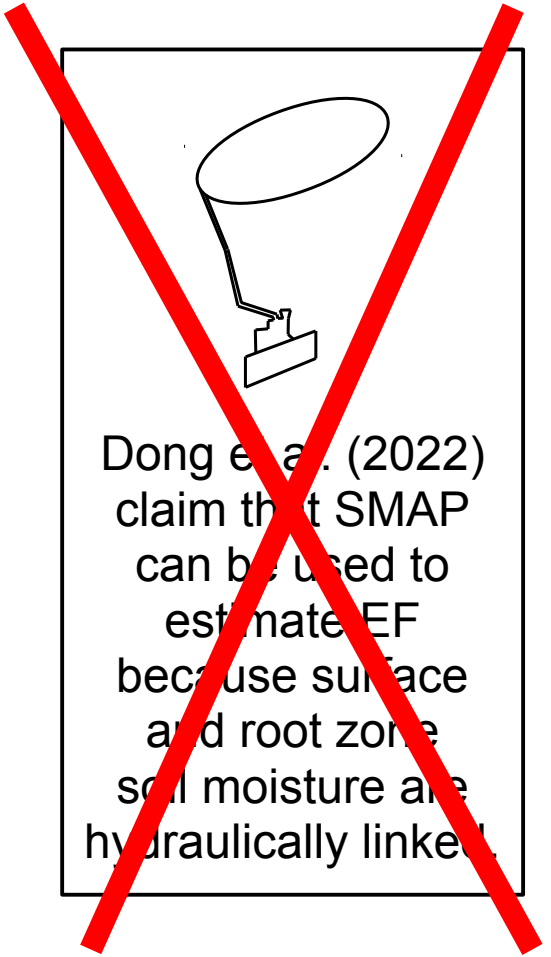


Figure 6.13, *Soil Science Simplified, 4th Edition.*

Credit: J. Frankenberger.

Credit: J. Kjaersgaard.

https://agwaterexchange.com/2016/06/17/tile-drainage-provides-cost-effective-water-retention-alternative/



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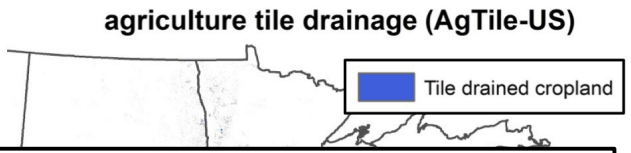
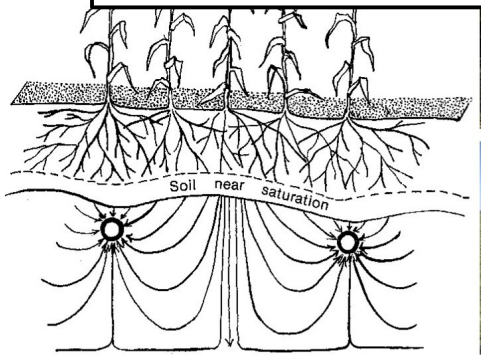


The only way to detect crop stress is to <u>infer stomatal conductance</u> via:

- reduced actual ET compared to PET;
- increased crop temperature;
- altered diurnal change in crop temperature;
- altered diurnal change of crop tissue water.



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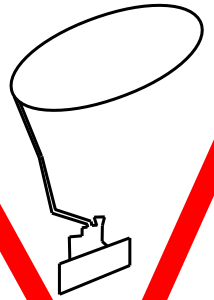

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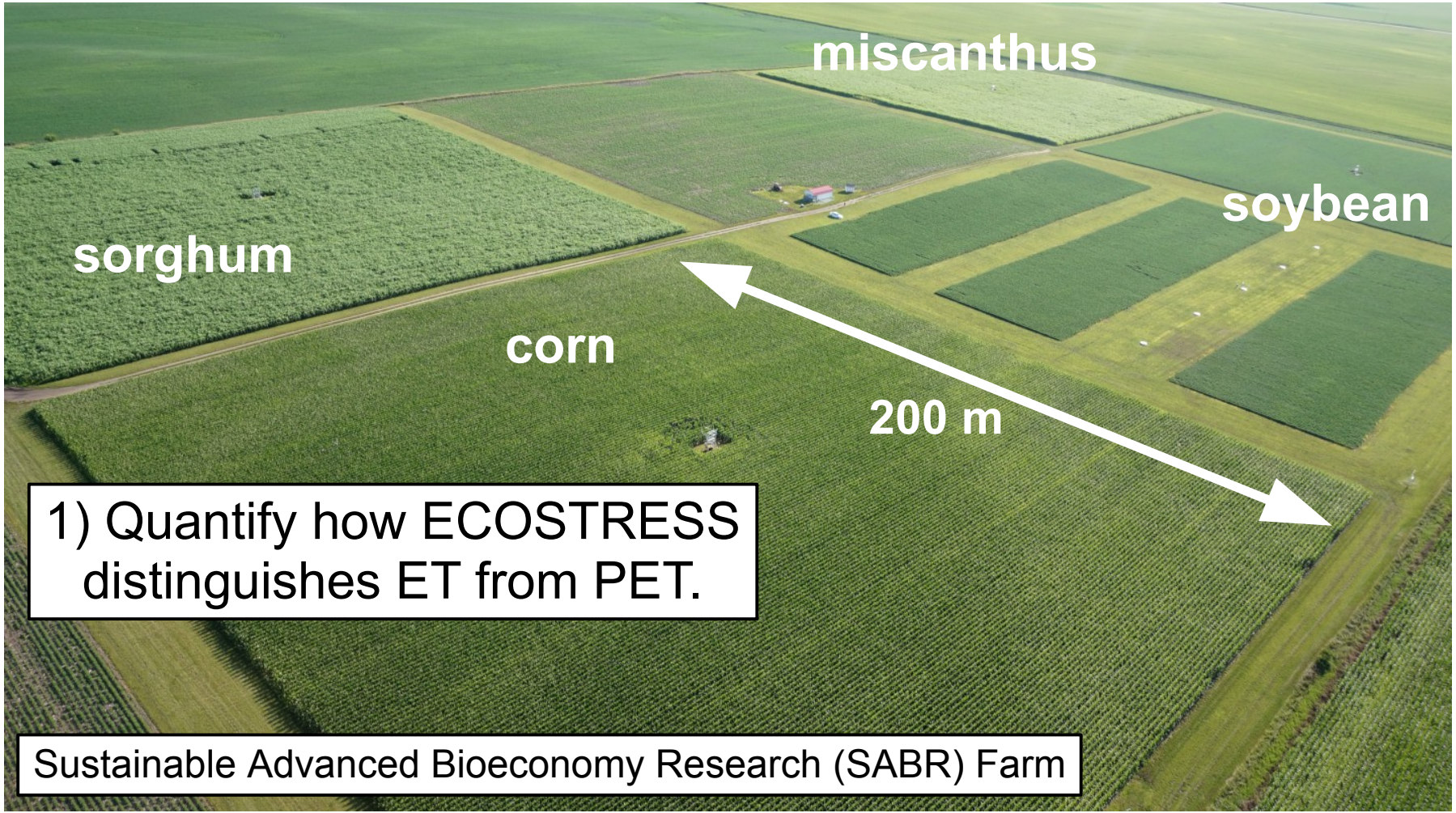

1) Quantify how ECOSTRESS distinguishes ET from PET.

Sustainable Advanced Bioeconomy Research (SABR) Farm

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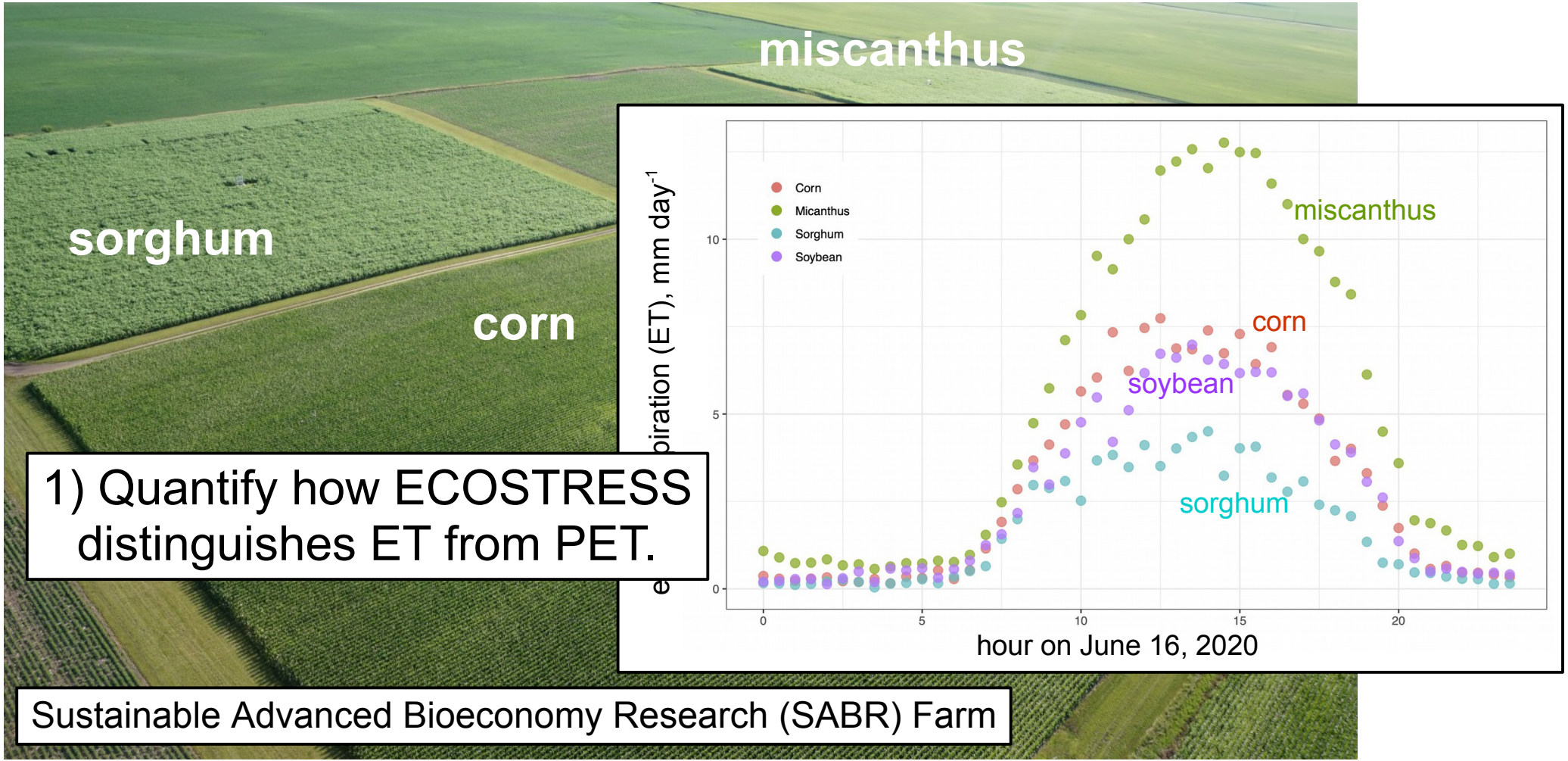

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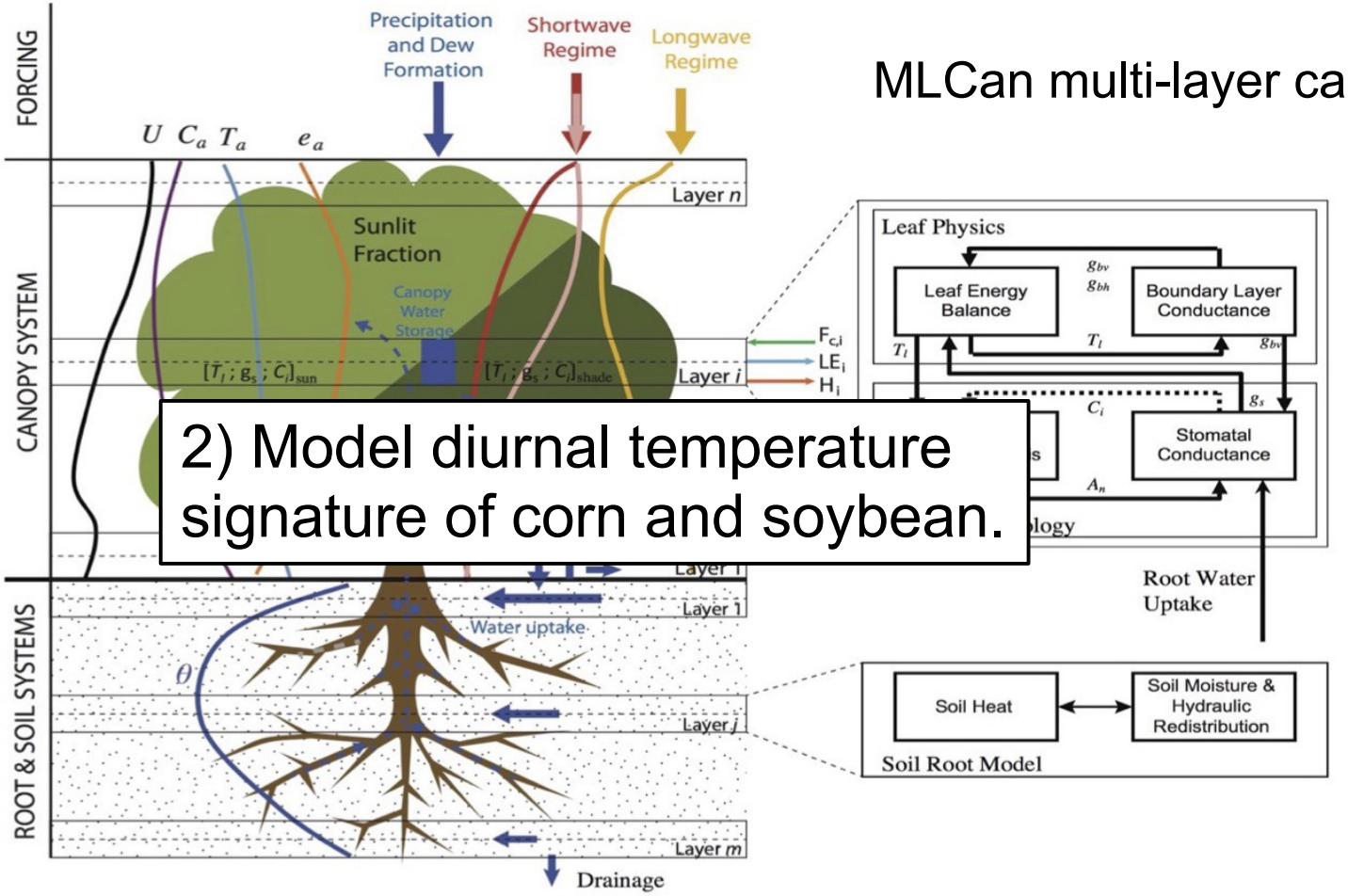
MLCan multi-layer canopy foliage model



2) Model diurnal temperature signature of corn and soybean.

MLCan capacity for hydraulic linkage

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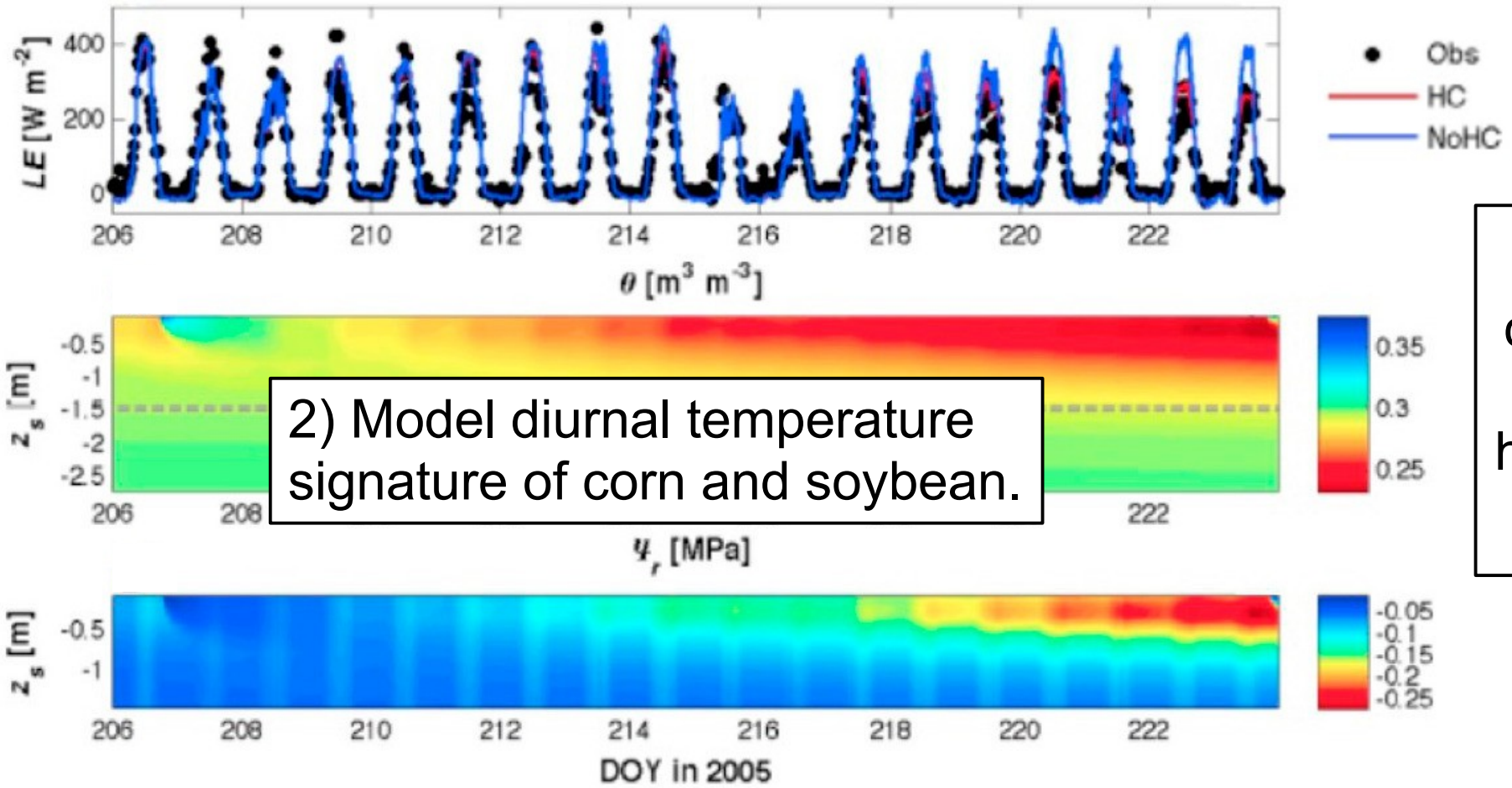

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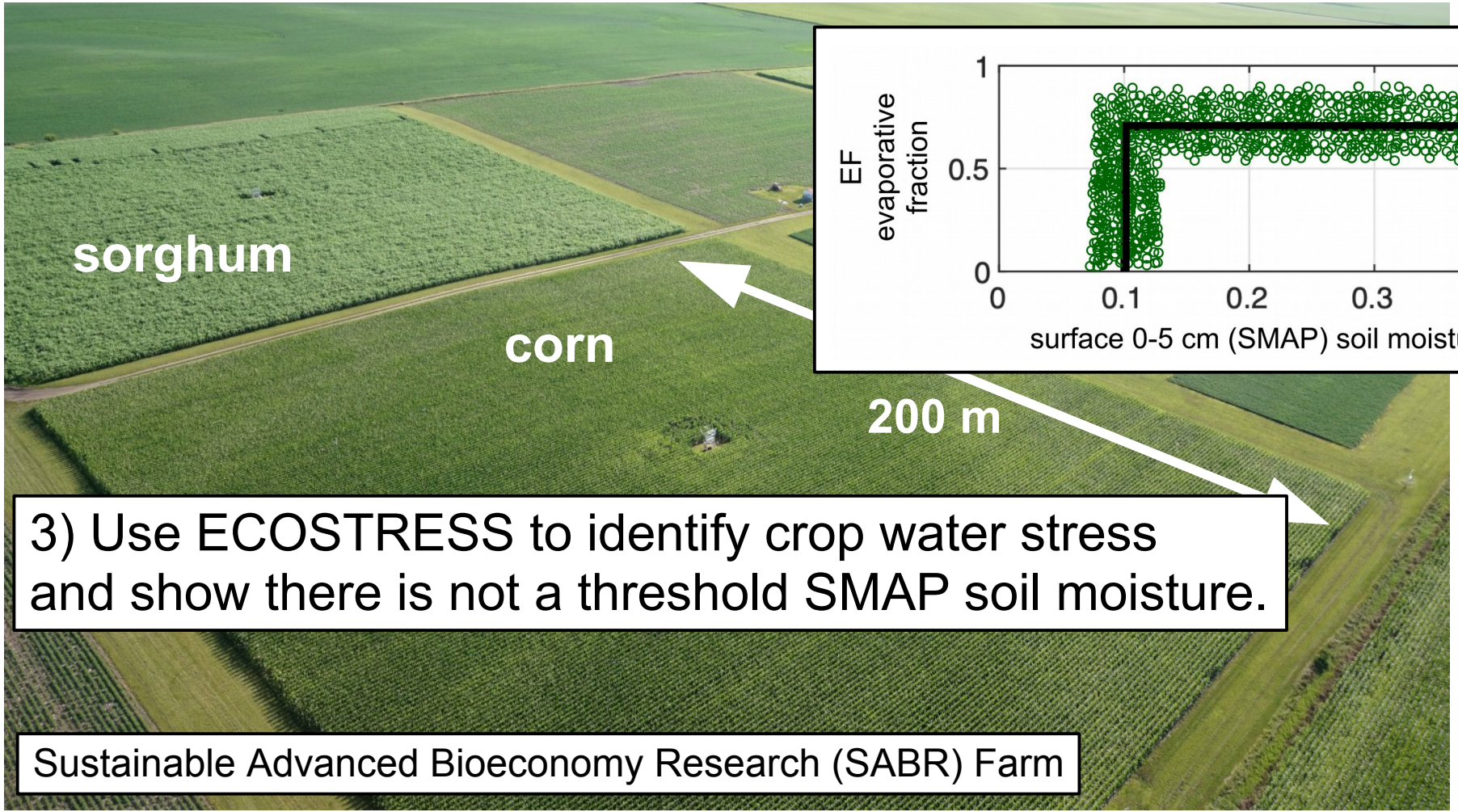

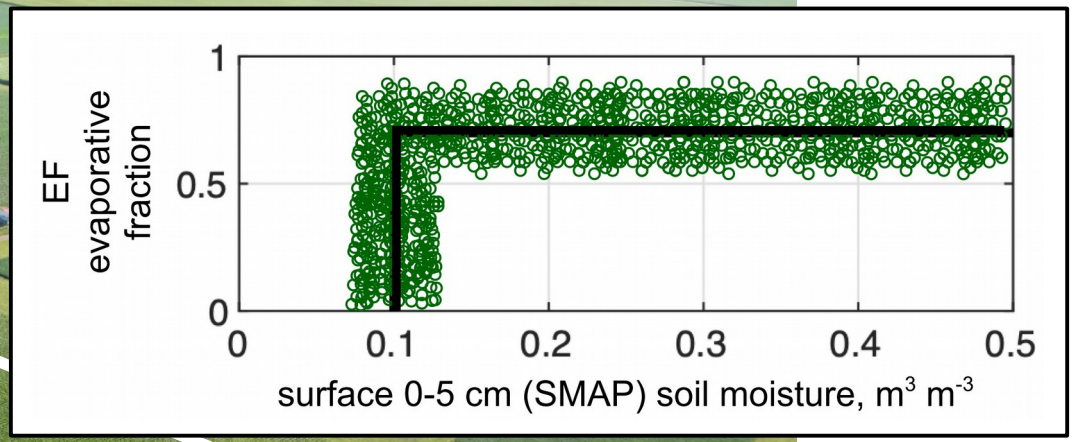

3) Use ECOSTRESS to identify crop water stress and show there is not a threshold SMAP soil moisture.

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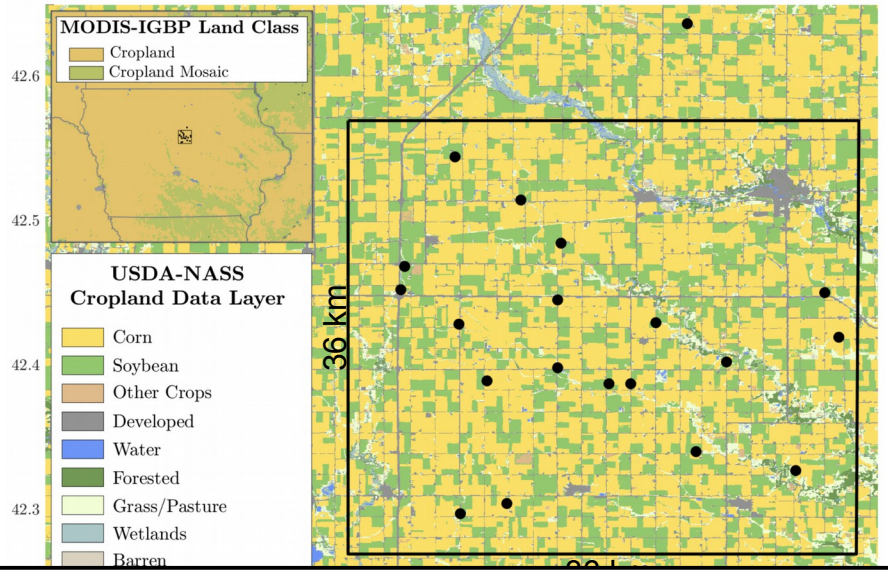
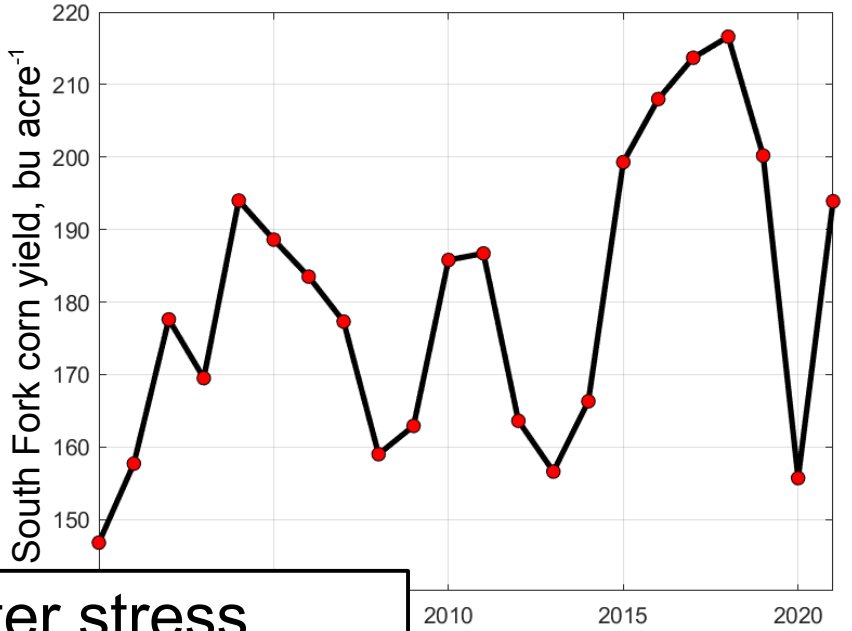
South Fork SMAP Cal/Val Site Soil Moisture Network





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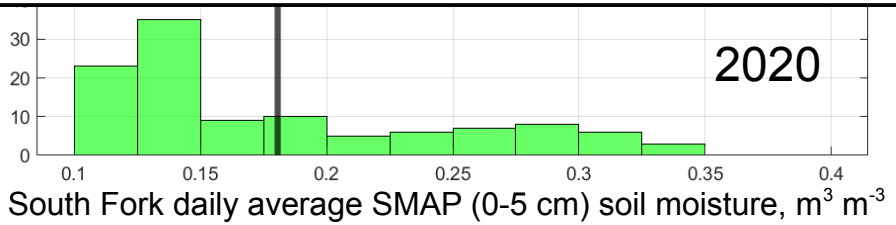

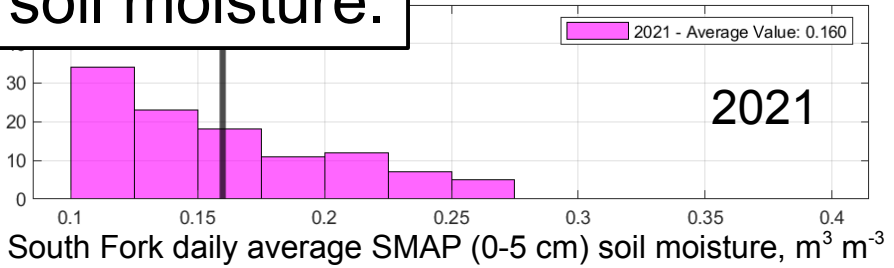

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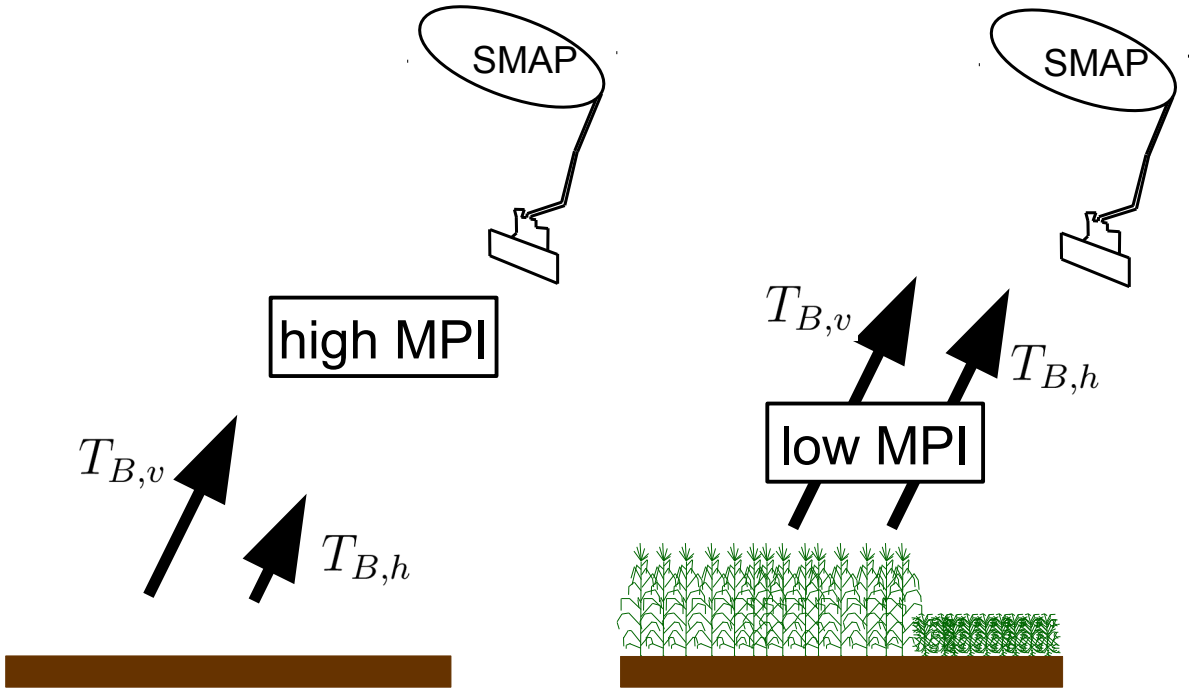
microwave polarization index

$$\text{MPI} = \frac{T_{B,v} - T_{B,h}}{\frac{1}{2}\left(T_{B,v} + T_{B,h}\right)}$$



4) Use ECOSTRESS to find crop water stress in SMAP pixels to determine if there is a diurnal crop tissue water signal.

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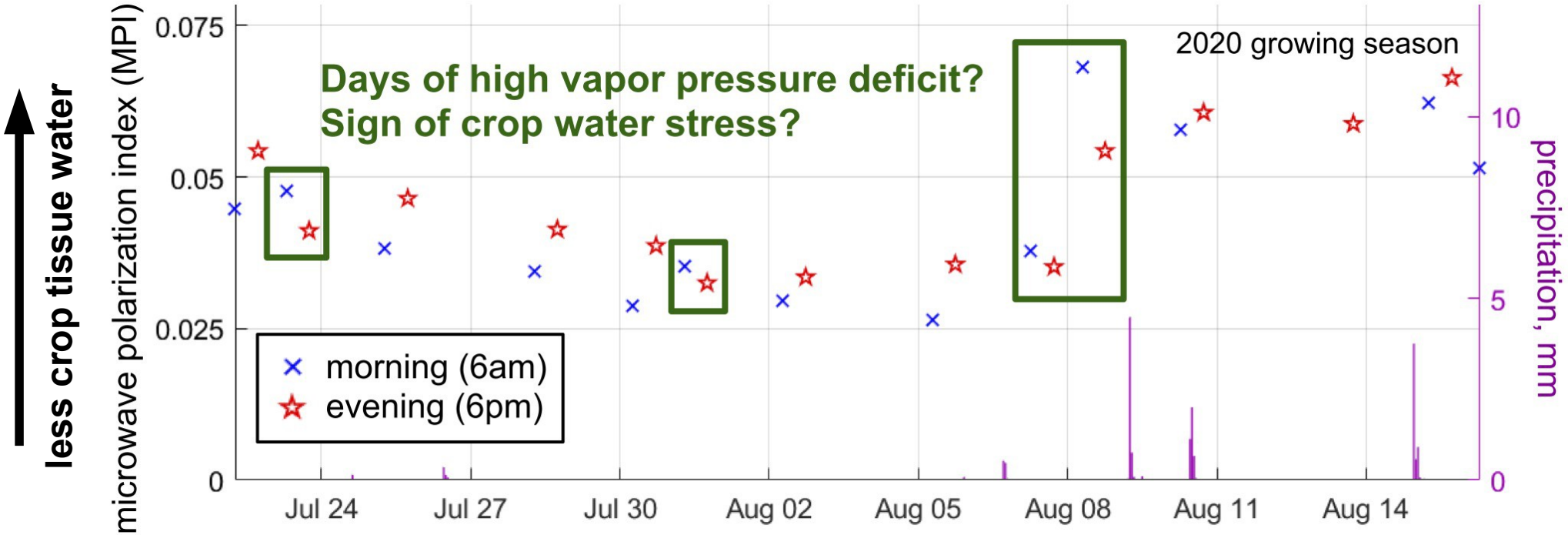

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ECOSTRESS

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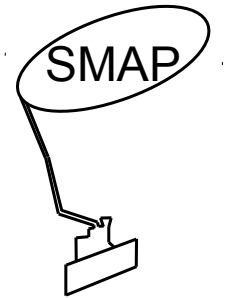

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