Exploiting Diurnal Cycles to Evaluate Vegetation Responses to Heat and Drought Stress

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Main objectives

- Leaf Level Experiments
  - How ET, photosynthesis, stomatal conductance, and SIF respond to a range of water and temperature stress?

- Site Level Analysis
  - Synchronization vs. Asynchronization?

- Regional Level Synthesis
  - Variations of energy, water, and carbon cycles for different land cover types in the climate sensitive Central Great Plains and the OzFlux Australia transits.

- Parallel efforts in ecosystem modeling - CliMA
  - test theories of stomatal optimization and their impacts on carbon and water fluxes
  - interpolate regional ECOSTRESS observations captured at different local times.
Leaf Level Experiments – REVY preliminary results

- **PAR**
  - Net Photosynthesis
- **T**
  - Stomata Conductance
- **VPD**
  - PSII yield
- **CO₂**
  - NPQ
- **Ft/Fo**
- **SIF**
- **SIF yield**
Leaf-to-Canopy Level Experiment – Russel Ranch, UC Davis

ECOSTRESS LST

Google Earth Image
Site Level

Ozark, Missouri

- Diurnal Cycle at Ozark site in summer 2012
- Peak drought (DOY 200-245)
- Before drought (DOY 125-160)
- Recovery (DOY 250-265)

- Latent Heat Flux (W/m²)
- PAR (µmol/m²/s)
- VPD (kPa)
- GPP (gC/m²/day)
- ET (W/m²)

- Before drought (May/June)
- Peak drought (August)
- After rain (beg. September)

- MODIS NDVI

- MOME-2 SIF (W/m²/sr/nm)
Flux site & satellite obs
Regional Scale

Australian January Mean Temperature

2019 Heatwave

"New" Australia T record at the time of the ECOSTRESS proposal 2019
SIF differences 2019 vs. 2018
2019 Midwest floods
2019 Midwest floods

How about ET?
ECOSTRESS & OCO-3 can help us looking into high-resolution regional patterns & diurnal variations!

Yin et al, AGU Advances, in press
Thank you!

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