Pissing in the wind:
How irrigation, falling snow, and dying leaves can change the weather

DESAI LAB, CPEP Seminar, 2 Oct 2018
Why you should apply for a Bryson/CPEP Seed Grant

• Short proposals provided partial support for graduate students (4) and experiments that led to preliminary data and figures for full agency proposals

• Connect to CCR scientists and affiliates, try new ideas, encourages students to write proposals

• Turn $25,000 (4 awards) into >$4,500,000 from NSF, DOE, Wisconsin DNR, and non-profits
Land-atmosphere coupling strength (JJA), averaged across AGCMs

Koster et al., 2004
Total Rainfall (inches):
July: 3.1
August: 7.3
September: 5.2

ET (mm/day):
July: 3.7
August: 1.8
September: 1.2
Land surface models require proper parameterization.
Maximum snow albedo – background surface albedo
Changing snow boundaries influences mid-latitude cyclone trajectories

$R^2 = 0.472627211396$
Large Eddy Simulations demonstrate the influence of land surface heterogeneity on atmosphere.

- Compared to homogenous surface energy balance forcing (left), a realistic pattern of surface heating leads to a non-random structure in the water vapor field (right). This LES was conducted over study domain. Dot = tall tower.
>15 “virtual” flux towers per 100 km² appear to be needed in a model to close energy balance in domain around tower using “naïve” approaches, but not so with advanced scaling methods.

**LES study (Xu et al., in review BLM)**

AERI retrievals at tall tower in Sept 2016 (lower right) demonstrates mesoscale PBL structures to be compared to diagram (top right)
July-October allows us to sample landscape as it evolves from homogenous LE (transpiration) driven, to patchier H and LE patterns depending on ecosystem

Chequamegon Heterogeneous Ecosystem Energy-balance Study Enabled by a High-density Extensive Array of Detectors (CHEESEHEAD19)

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- Phil Townsend, U. Wisconsin-Madison (co-PI)
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- NCAR, U Wyoming, NASA, NEON, DOE
Thanks!

- Irrigation: Ammara Talib (PhD), Molly Aufforth (MS), Jess Turner (MS), Jonathan Thom (MS)
  - Wisconsin Potato and Vegetable Growers, WI DNR, NSF Advances in Biological Informatics (ABI)

- Snow: Ryan Clare (MS), Melissa Breeden (PhD), Anthony Crespo (MS), Matt Rydzik (MS), Gabe Bromley (BS), Mike Notaro, Steve Vavrus, Jon Martin
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- Leaves: Ke Xu (PhD), Sreenath Paleri (PhD), Bailey Murphy (MS), Kip Nielson (BS), Jonathan Thom (MS)
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