

Characterizing Near-surface Moisture Increase During the Afternoon-to- Evening Transition Using a Single Column Model

Siwei He (siwei.he@noaa.gov), Julia Simonson, David Turner, Stanley Benjamin, Tilden Meyers, Joseph Olson, and Tatiana Smirnova

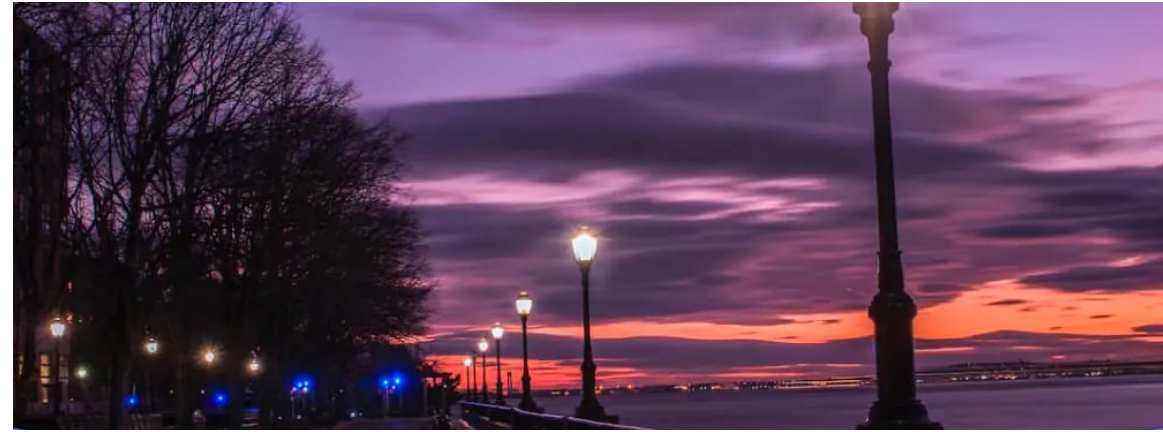
NOAA Global System Laboratory
CIRES, University of Colorado Boulder

August 10, 2023



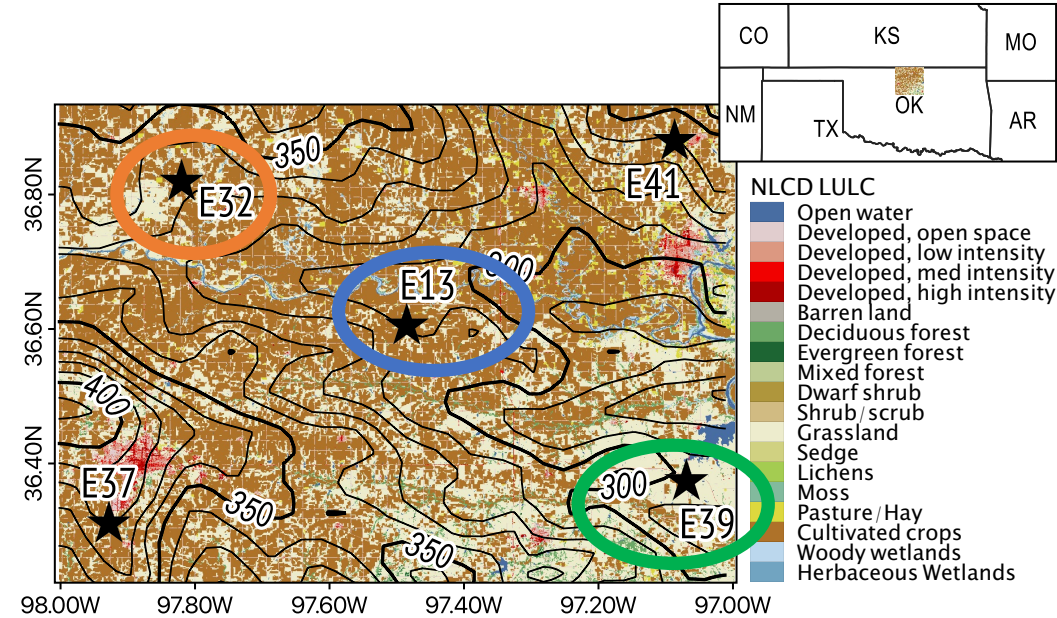
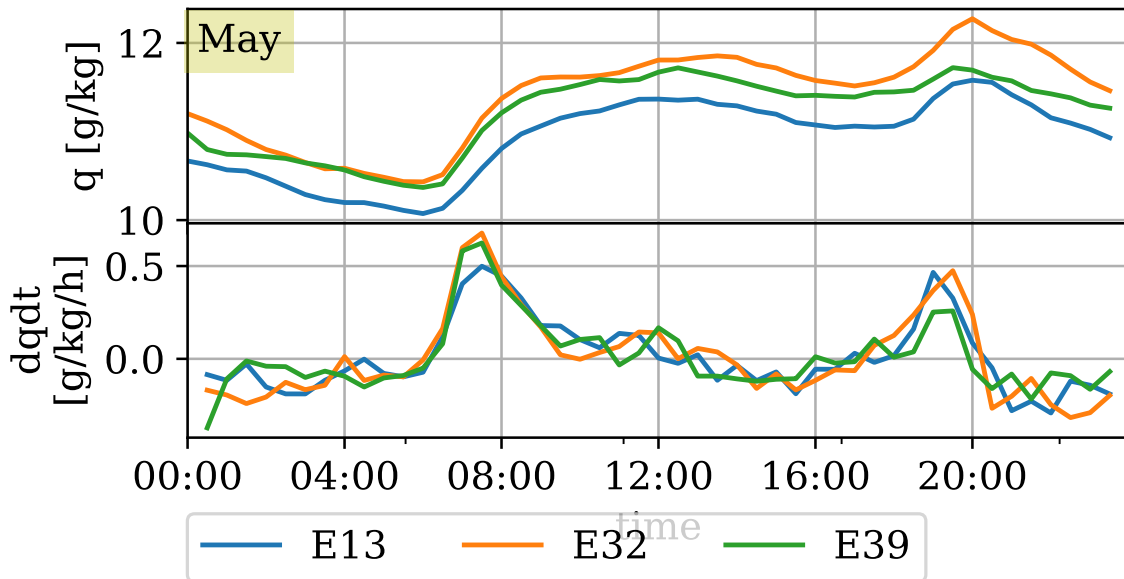
Afternoon to evening transition

- Afternoon to evening transition is the short period before sunset:
 - Transition from convective/unstable state to stable state



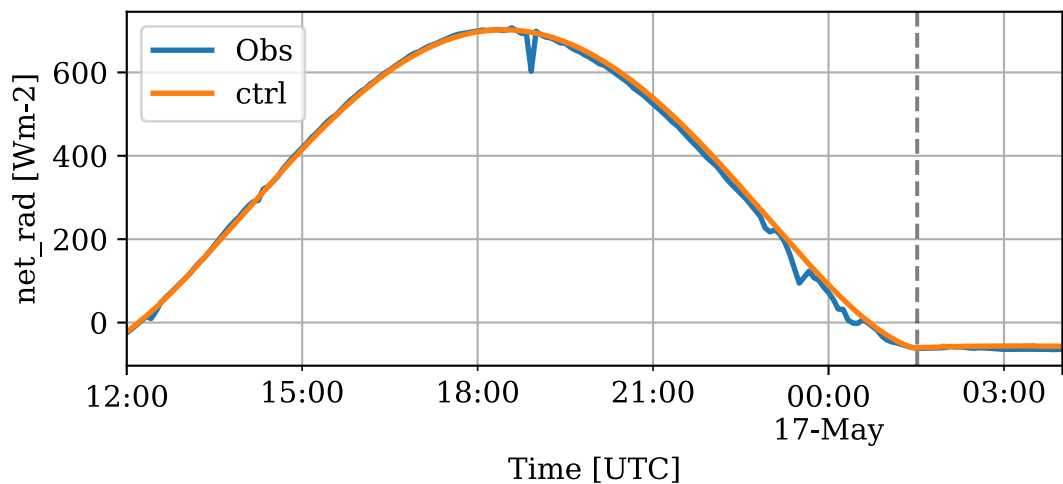
Near-surface water vapor increase

- 2-m mixing ratio diurnal variations and its temporal gradients from a 3-years in-situ observations

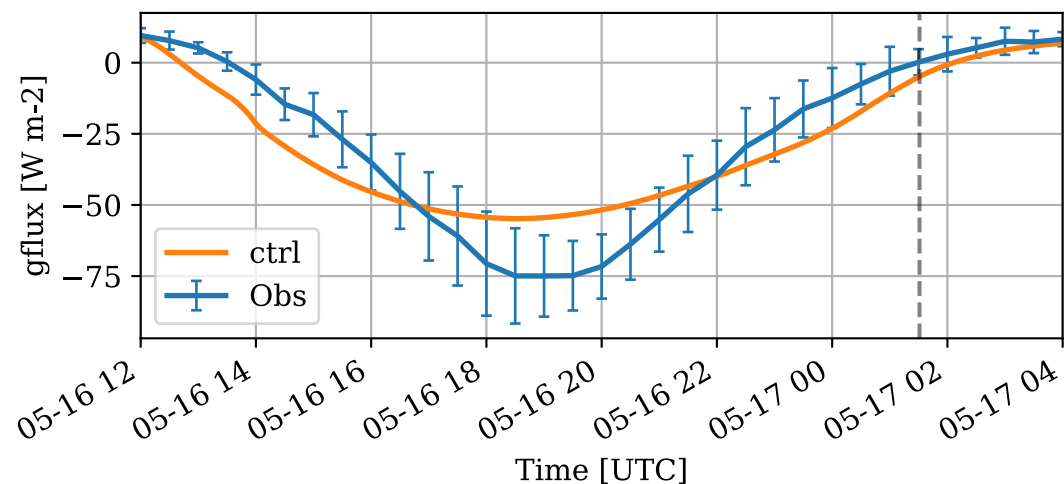


The mechanism and sources of
water vapor increase?

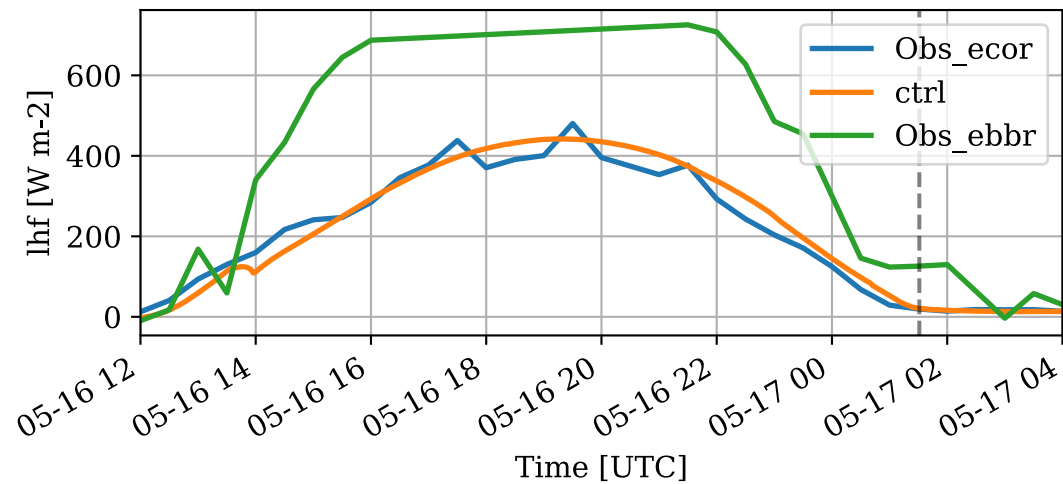
May 16, 2019



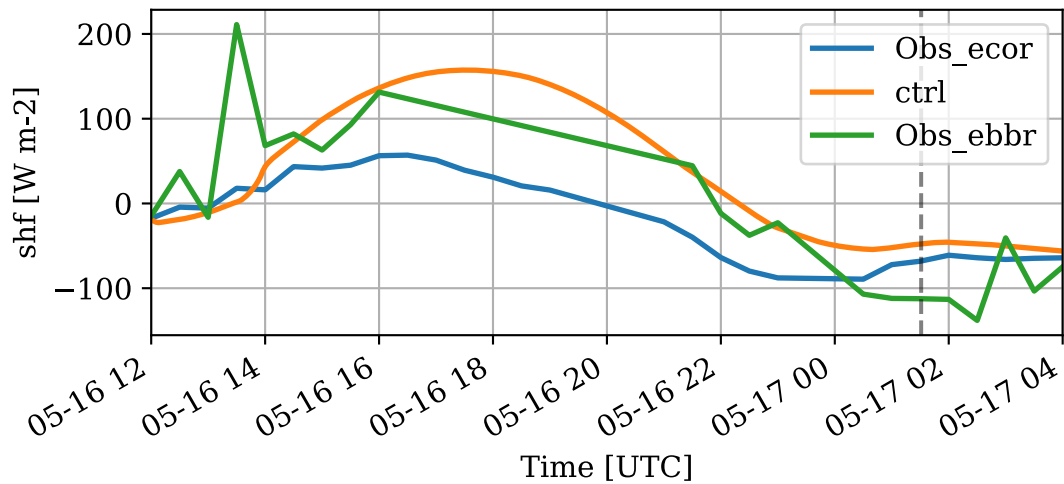
Net radiation



Ground heat flux

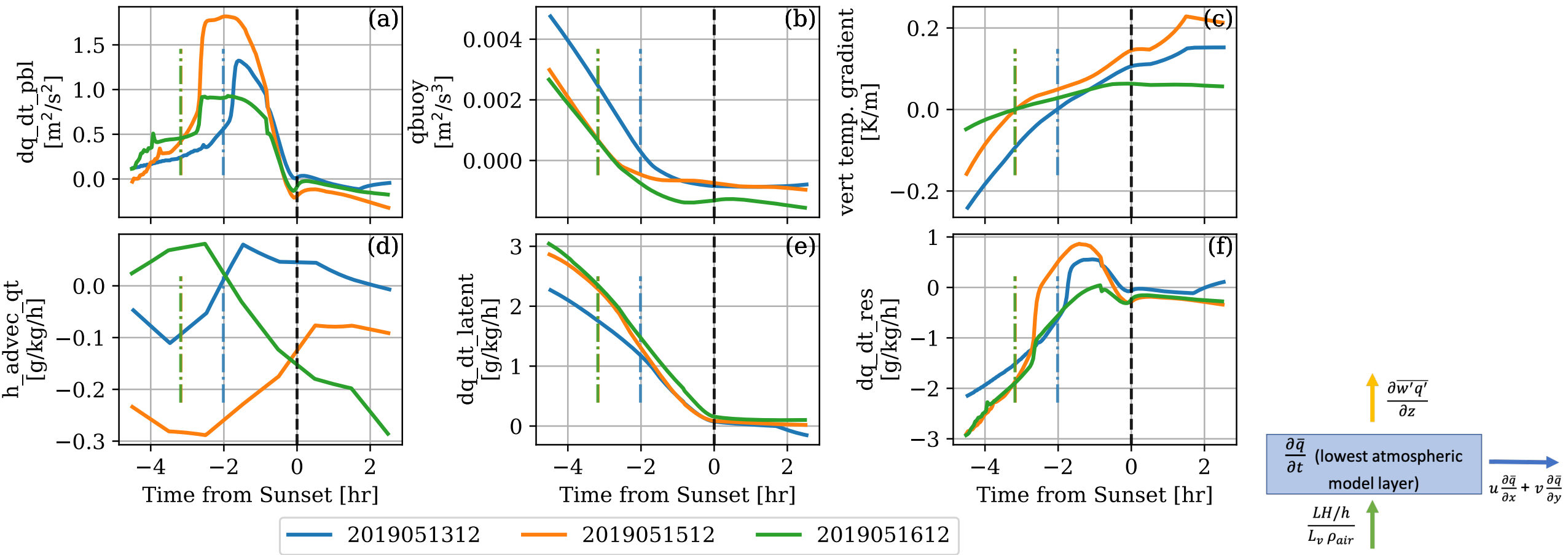


Latent heat flux



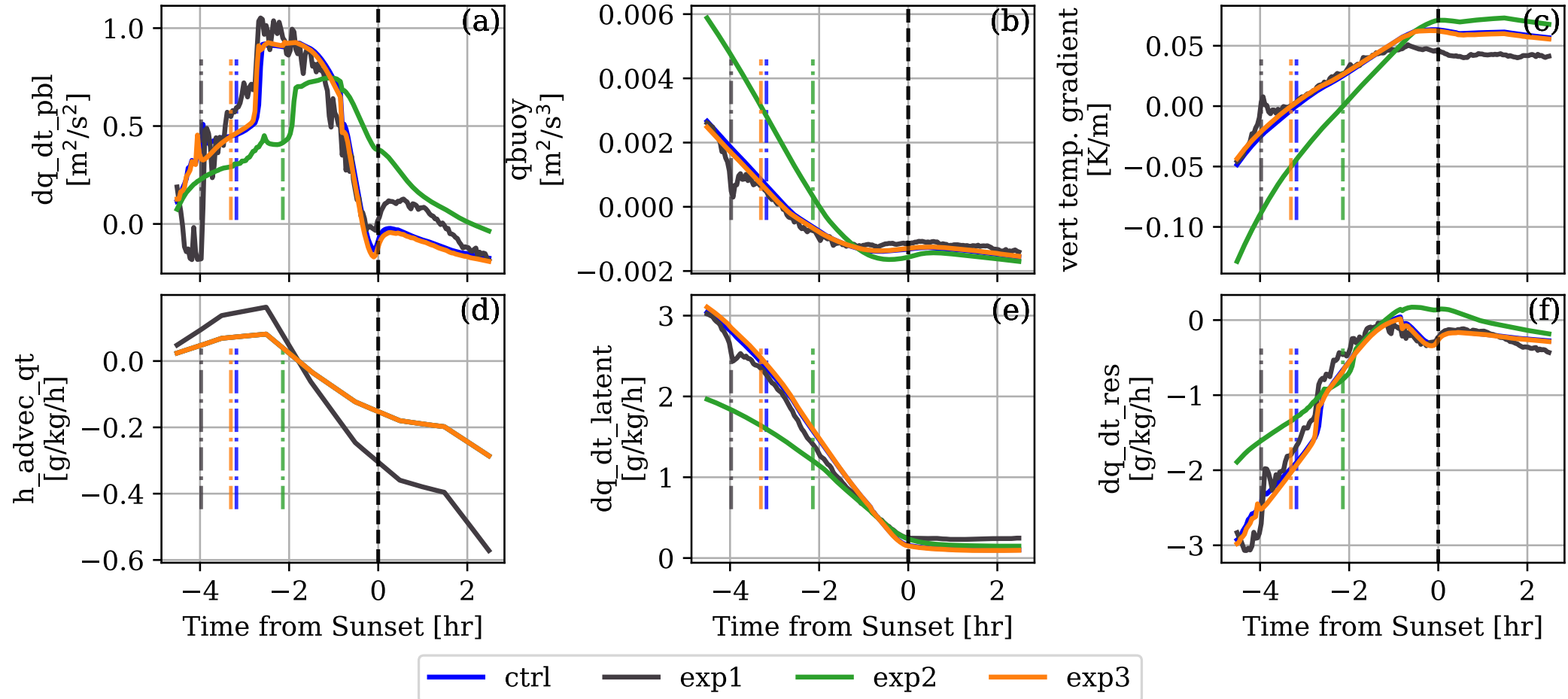
Sensible heat flux

Water vapor increase before sunset



- (a) total temporal gradient of water vapor
- (b) TKE tendency due to buoyancy production
- (c) vertical temperature gradient between the skin and the bottom-most model layer
- (d) water vapor change due to horizontal advection
- (e) water vapor change due to evapotranspiration
- (f) water vapor change due to turbulence

The Impact of Advection and Land Cover



ctrl: default real;

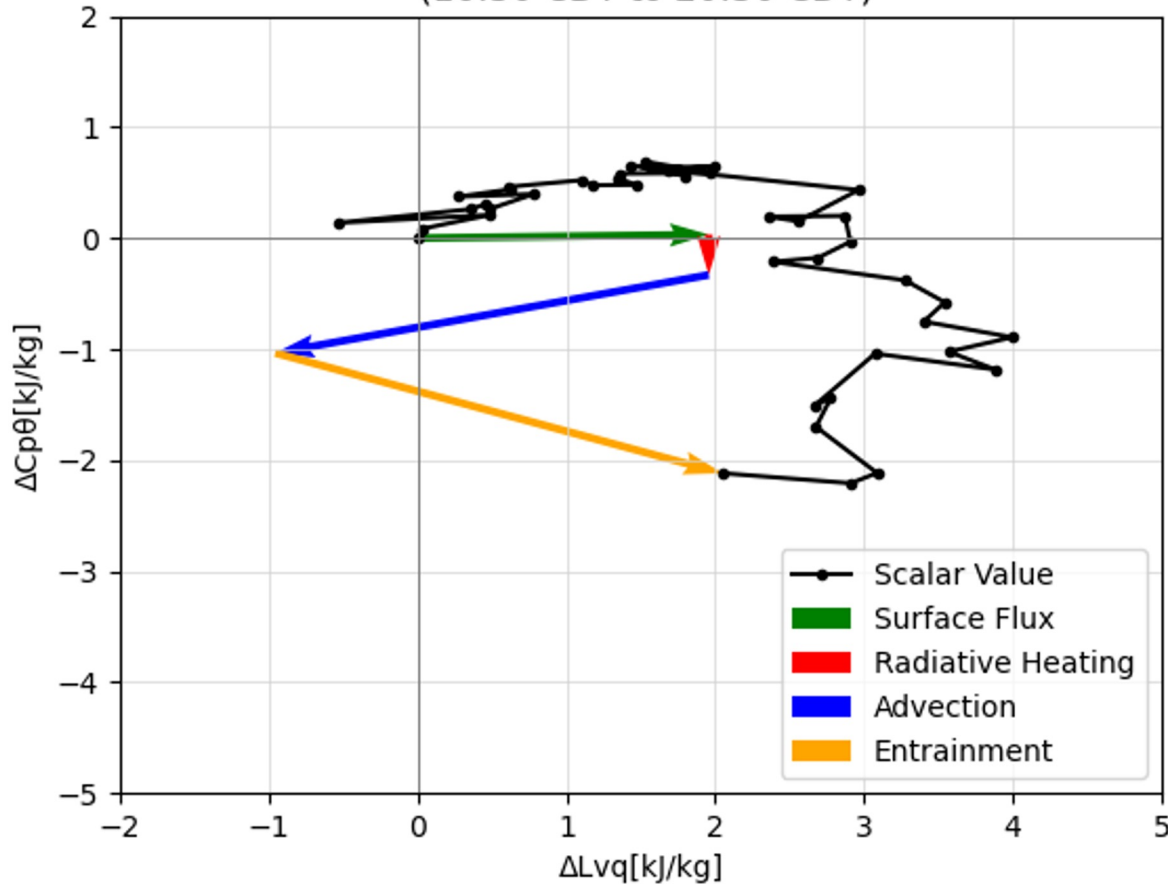
exp2: sparse vegetation;

exp1: strong advection;

exp3: dense vegetation.

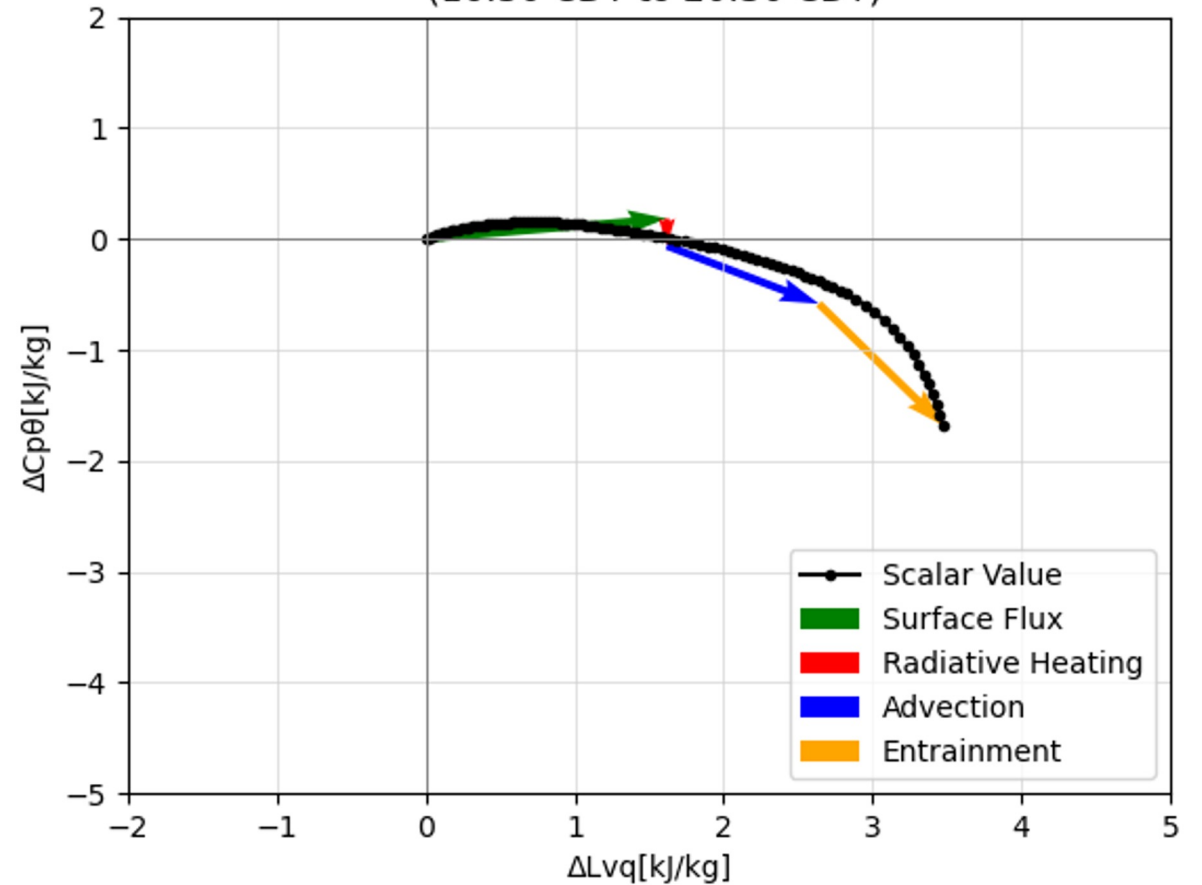
Mixing diagrams reveals additional info

13 May 2019
21:30 UTC to 01:30 UTC
(16:30 CDT to 20:30 CDT)



Observation: before sunset

13 May 2019
21:30 UTC to 01:30 UTC
(16:30 CDT to 20:30 CDT)



Simulation: before sunset