MATERHORN U of U Summary

Eric Pardyjak

MATERHORN Annual Investigator Meeting – V

October 7-8, 2014

University of Notre Dame

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Summary of Accomplishments

BLM Special Issue Papers

- Hang, C., D.F. Nadeau, D. D. Jensen, S.W. Hoch and E.R. Pardyjak, Playa soil moisture and evaporation dynamics during the MATERHORN field program, Boundary-Layer Meteor., DOI: 10.1007/s10546-015-0058-0, 2015.
- Jensen, D.D., D.F. Nadeau, S.W. Hoch and E.R. Pardyjak, Observations of near-surface heat flux and temperature profiles through the early evening transition over contrasting surfaces, DOI: 10.1007/s10546-015-0067-z, Boundary-Layer Meteor., April 2015.
- Oldroyd, H.O., E.R. Pardyjak, H. Huwald, M.B. Parlange, Adapting tilt corrections and the governing flow equations for steep, fully three-dimensional, mountainous terrain, Boundary-Layer Meteor., DOI: 10.1007/s10546-015-0066-0, 2015.
- Grachev, A.A., L.S. Leo, S. Di Sabatino , H.J.S. Fernando, E.R. Pardyjak, and C.W. Fairall, Structure of turbulence in katabatic flows below and above the wind-speed maximum, Boundary-Layer Meteor., 10.1007/s10546-015-0034-8, 2015.

Summary of Accomplishments

AMS Special Issue

- Lehner, M., C.D. Whiteman, S.W. Hoch, D. Jensen, E.R. Pardyjak, A case study of the nocturnal boundary-layer evolution on a slope at the foot of a desert mountain, *J. Appl. Meteorol. Climat.*, 54, 732–751., 2015.

ACP BLLAST Special Issue

- Blay-Carreras, E., E.R. Pardyjak, D. Pino, S.W. Hoch, J. Cuxart, D. Martínez, and J. Reuder, Lifted temperature minimum during the atmospheric evening transition, *Atmos. Chem. Phys.*, 15, 6981–6991, 2015.

Other

- Holmes, H., Sriramasamudram, J., Pardyjak, E.R., Whiteman, C., Turbulent fluxes and pollutant mixing during wintertime air pollution episodes in complex terrain, accepted, *Environmental Science & Technology*, October 2015.

Countergradient Heat Fluxes During the Evening Transition

The analysis provide a way implement an MOST improvement

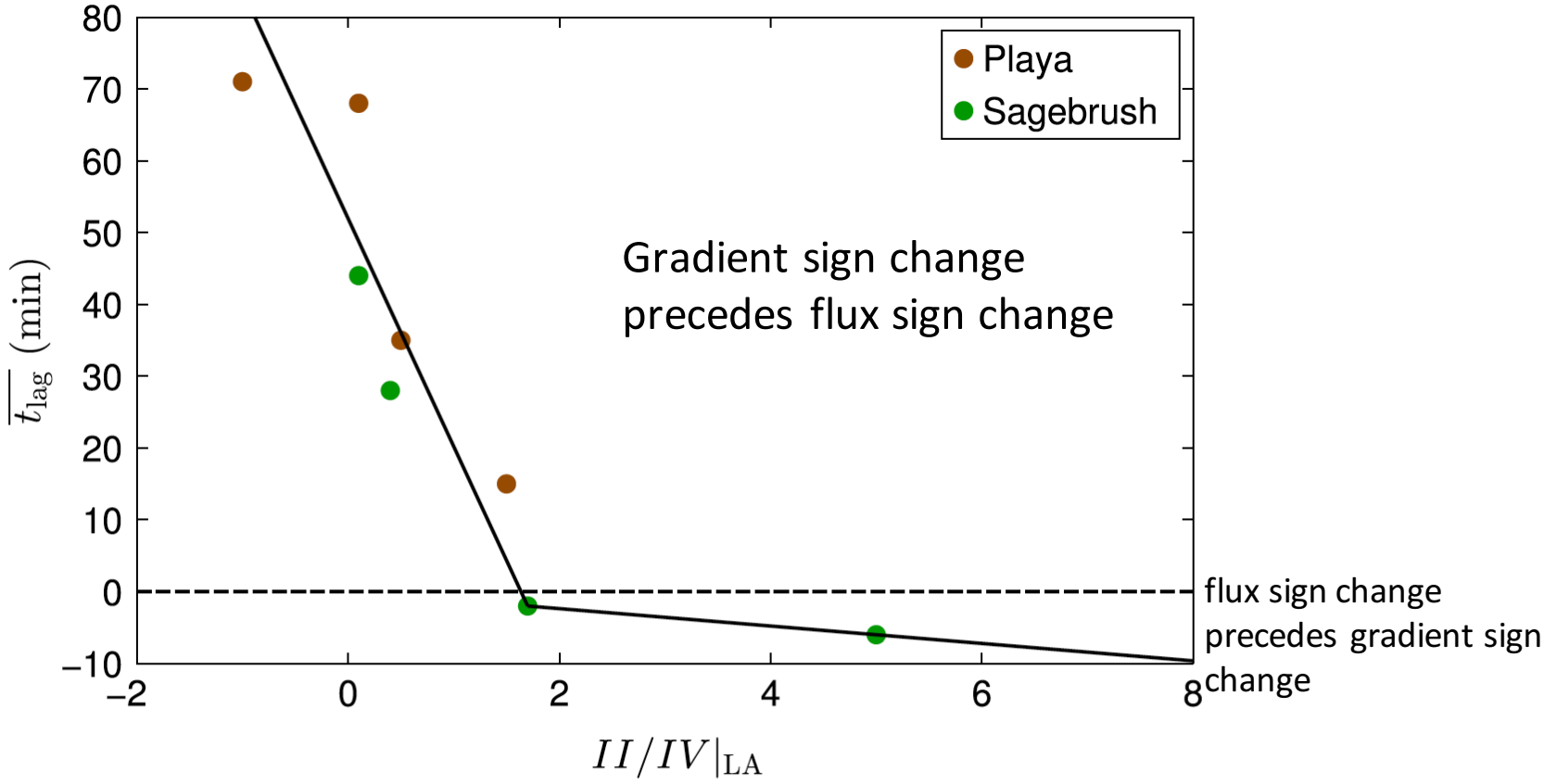
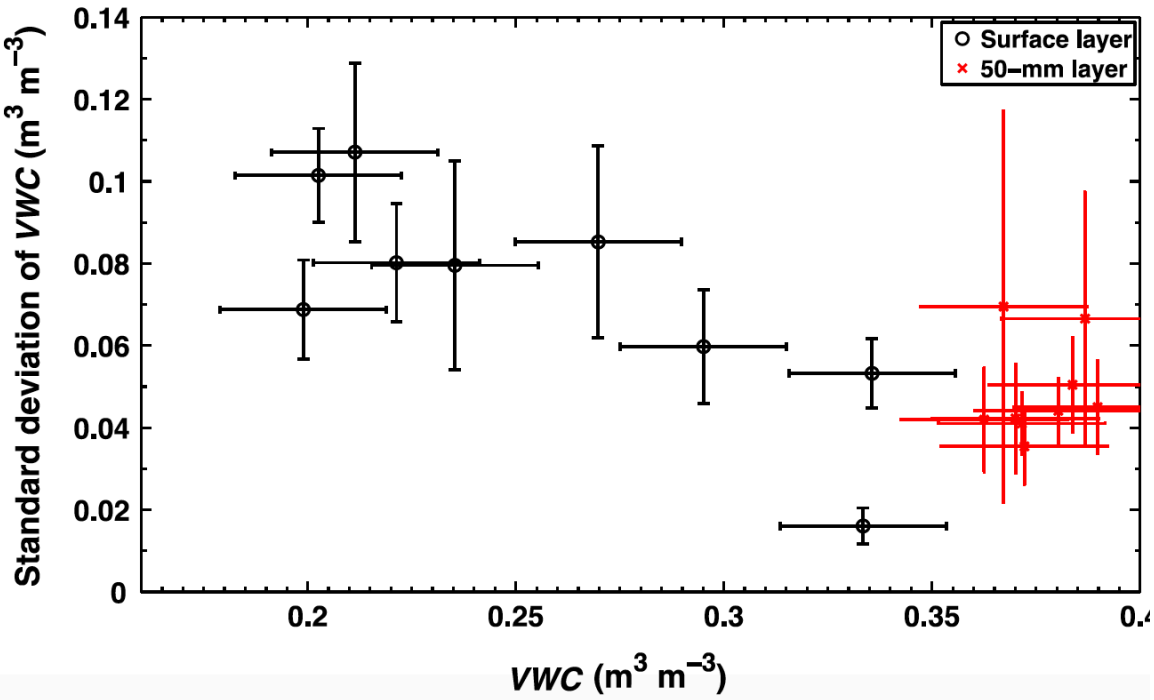


Fig. 16 Mean lag times as a function of the late afternoon (LA) ratio of the gradient (term II) to buoyant production (term IV) terms in the heat-flux tendency equation (Eq. 6) for all heights at the Playa and Sagebrush sites. The *solid black lines* are a best, linear fit of the data

Playa Soil Moisture and Evaporation Dynamics

Key Findings

- Playa soil moisture is very heterogeneous – particularly during dry periods
- Strong temporal variability, particularly after rain events
  - Very short drying time scale
  - Substantial impact on the energy balance



E.R. Pardyjak

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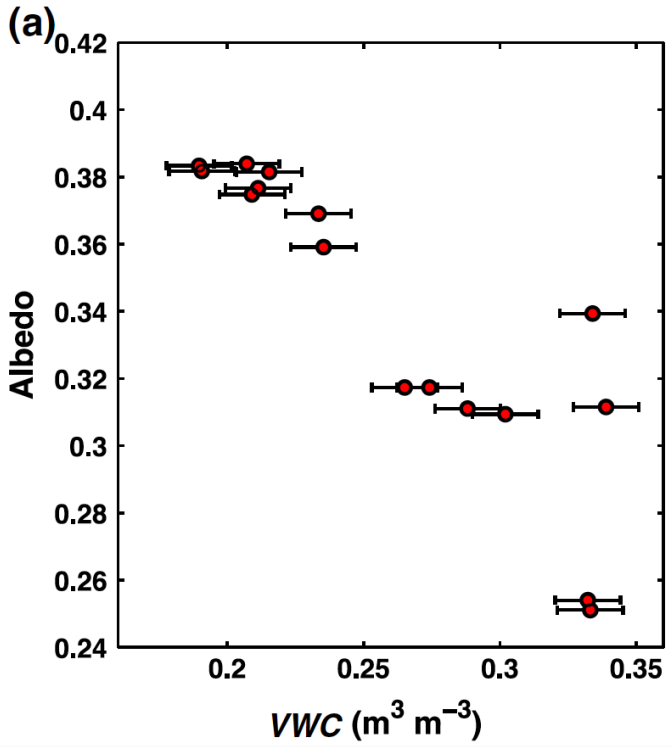
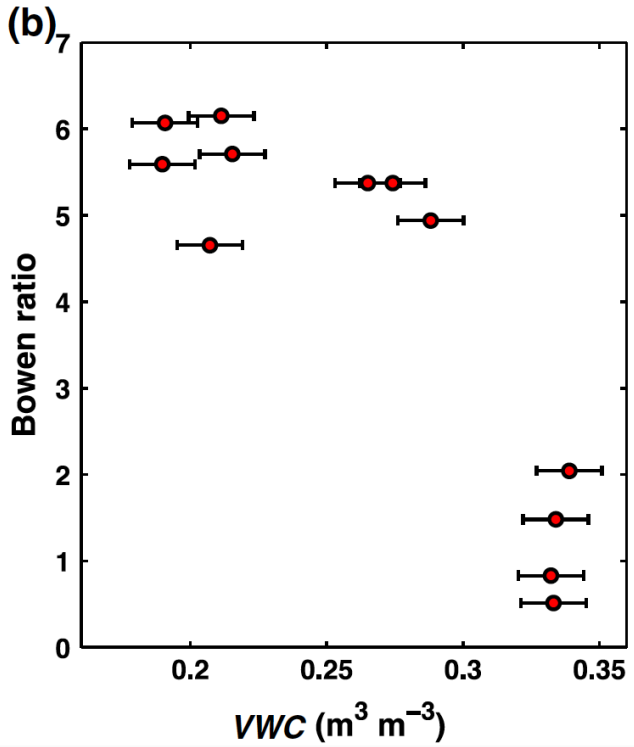




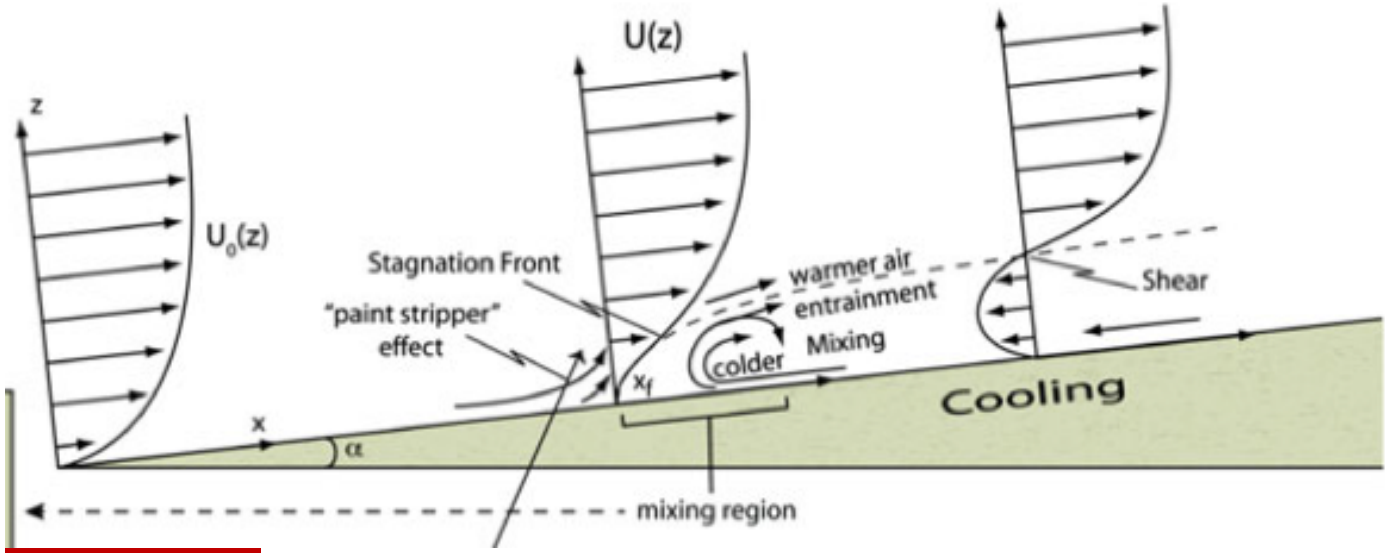
Playa Soil Moisture and Evaporation Dynamics

Key Findings

- May was “wet” - total precipitation (25 mm) exceeded cumulative evaporation (19 mm)
- Nocturnal evaporation is important (up to 30%)

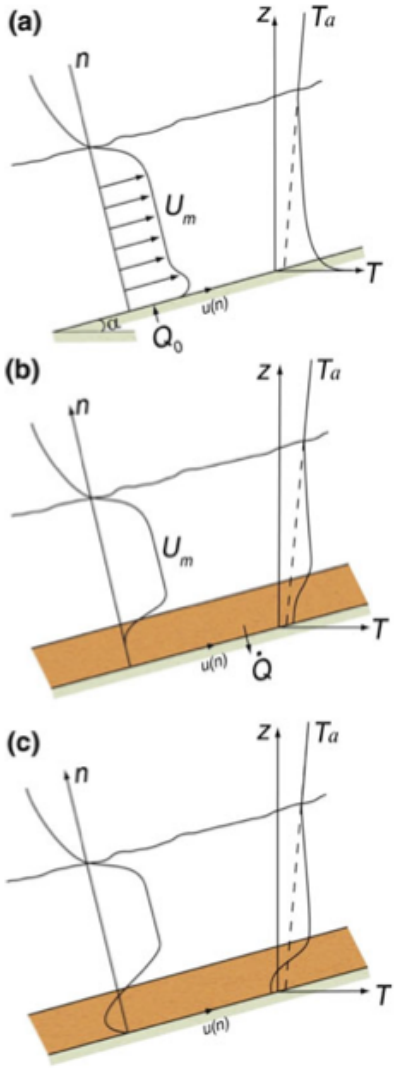
Evening Transition Dynamics on the East Slope

Non-local Front

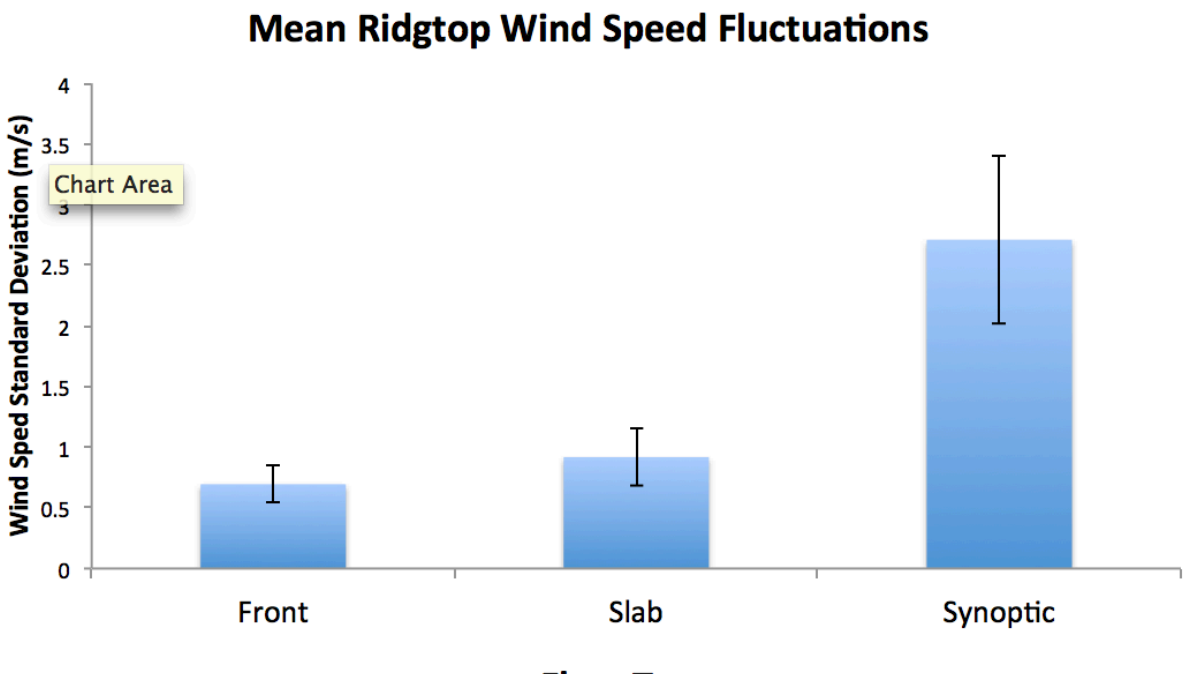


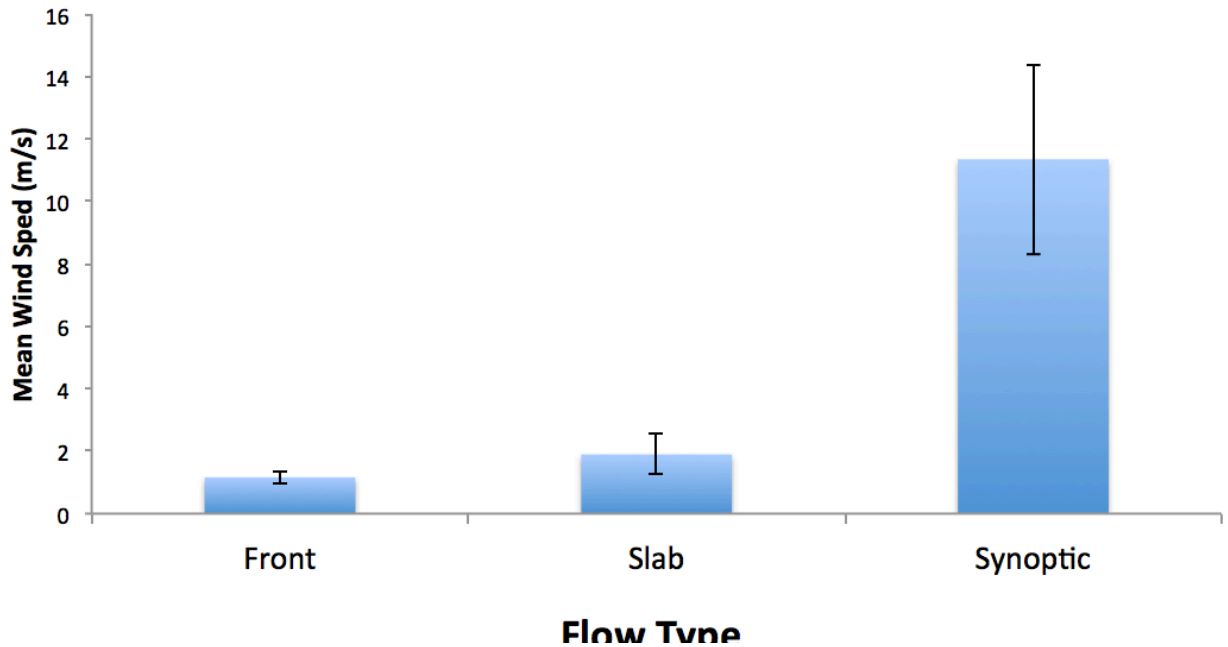
From Fernando et al. 2013 BLM

"Sliding Slab" Transition (Local)



Large Scale Influence? Meso vs synoptic





10 Cases from Fall 2012

- 4 Frontal
- 4 Slab

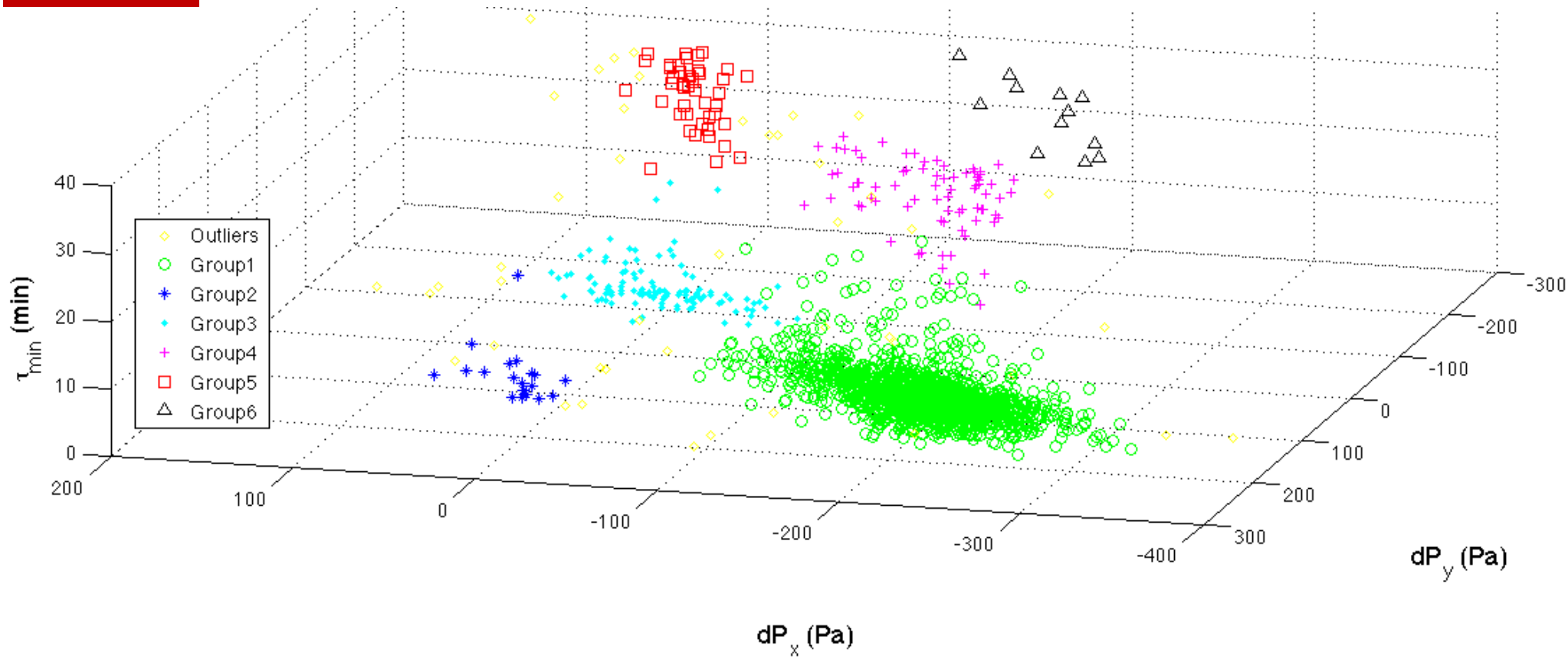
  2 Synoptic

Evening Transition Dynamics on the East Slope

- Cluster Analysis (DBSCAN) was used to identify different patterns in the data (e.g. slab vs front transition)
- Data from MATERHORN campaign and 4 years of PWIDS
- The most successful clustering occurred when using the following inputs
  - range-scale pressure gradients
  - the time delay of the two-point velocity structure function minimum (t_{min}) on towers along the East Slope

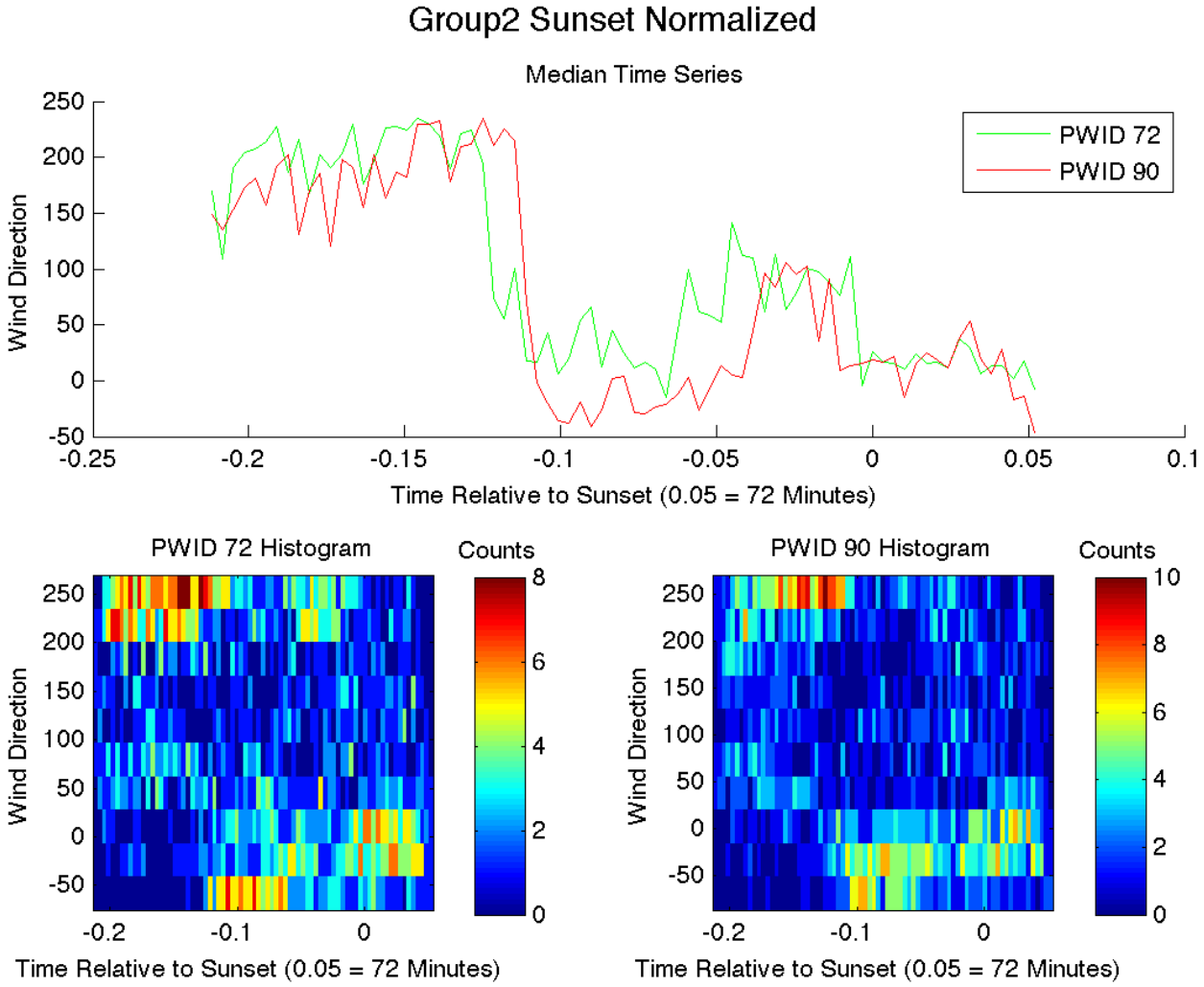
Evening Transition Dynamics on the East Slope

Identified Clusters



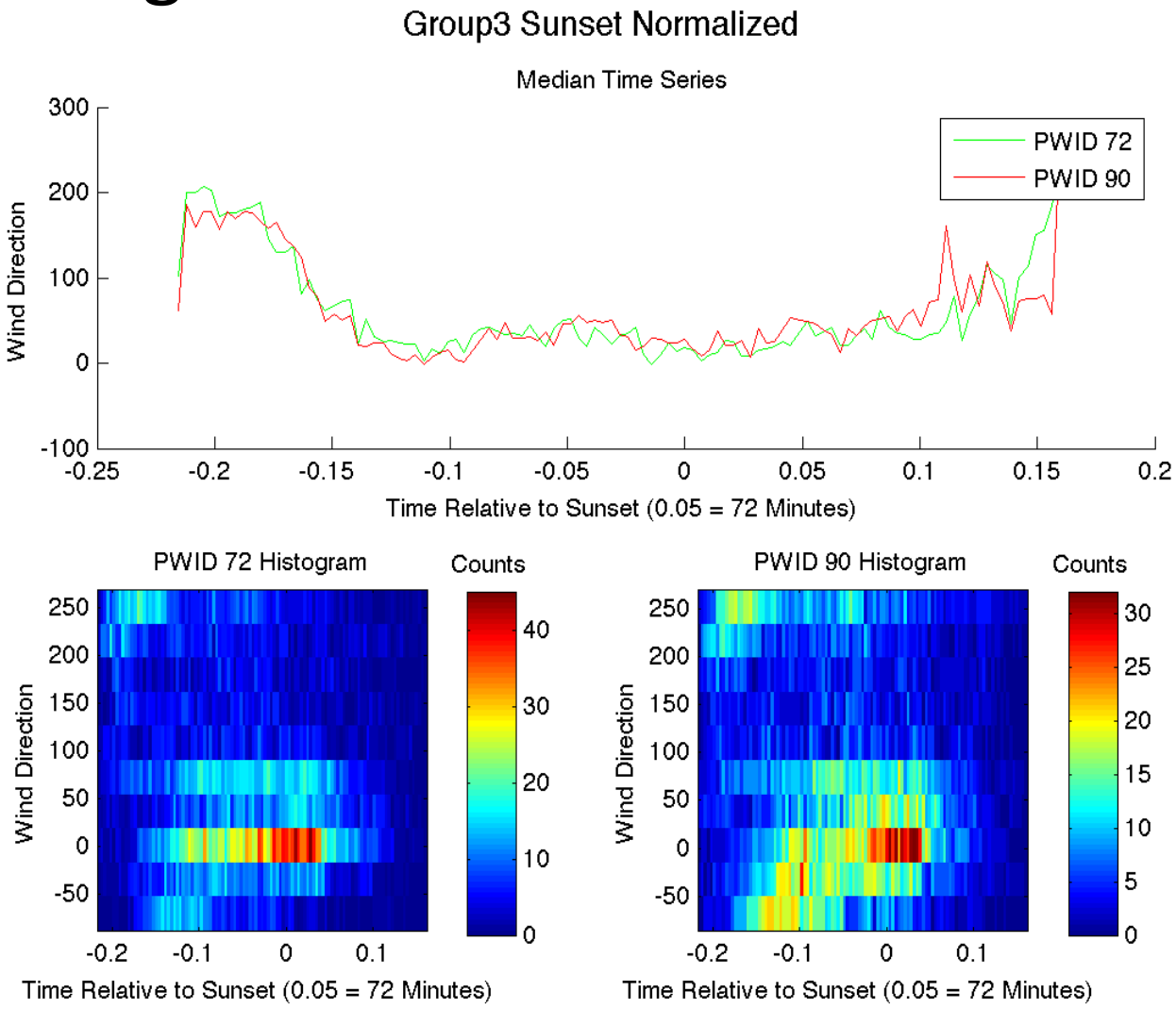
Evening Transition Dynamics on the East Slope

Front



Evening Transition Dynamics on the East Slope

Sliding-Slab



Planned Scientific Activities

- Derek
  - Understanding the role of soil moisture on slope flow transition and evolution dynamics
- Chao
  - Temporal evolution of scalar variances
  - Understanding the role of the turbulence in the evolution of the fog
- Eric/Dave/Sebastian/Nipun
  - Evening Transition Dynamics
  - Modeling sensible heat fluxes using thermal imagery