

# Multi-Scale Interactions in the Planetary Boundary Layer over Complex Terrain

Matt Jeglum, Sebastian Hoch  
MATERHORN Investigator Meeting 2014  
10/9/2014

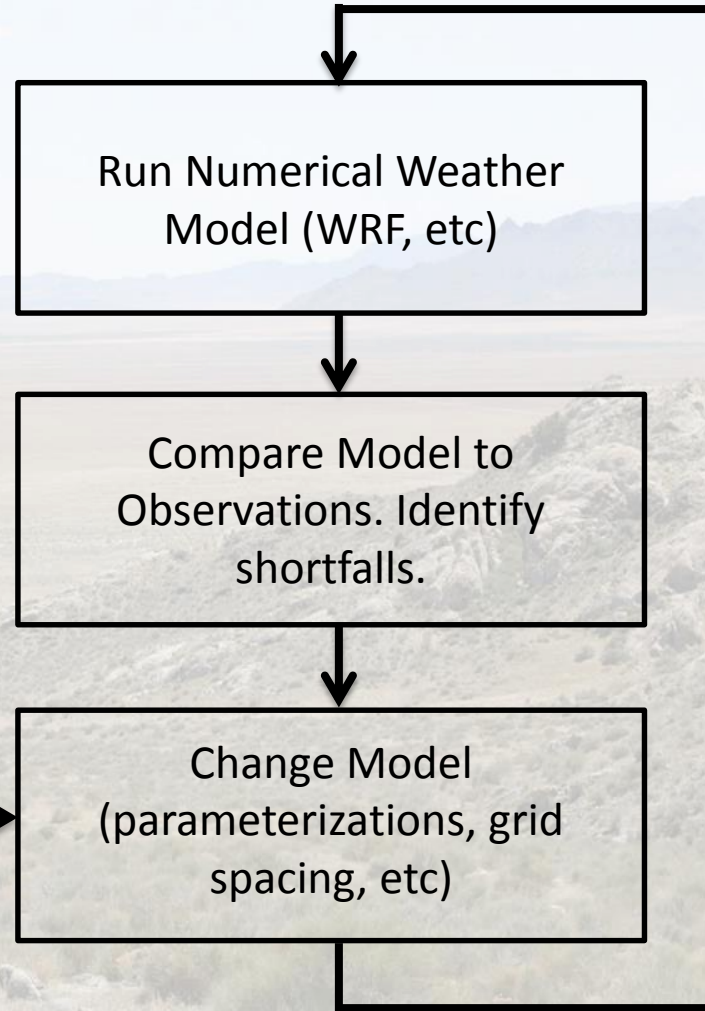


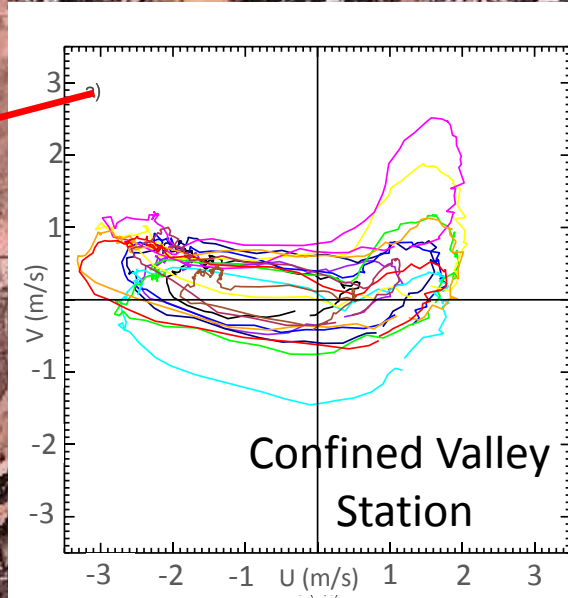
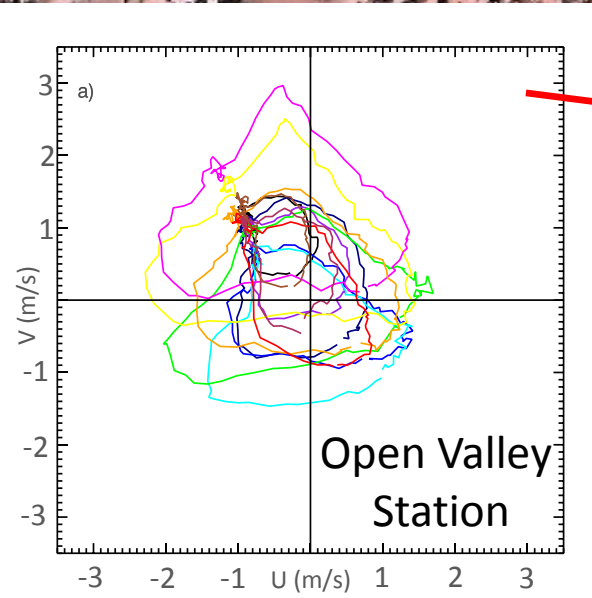
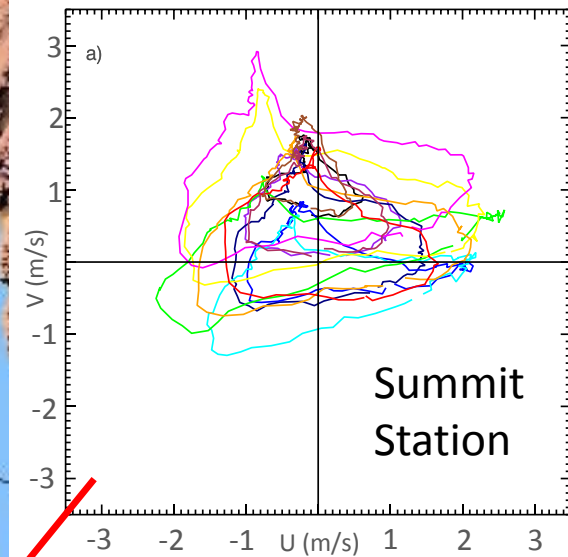
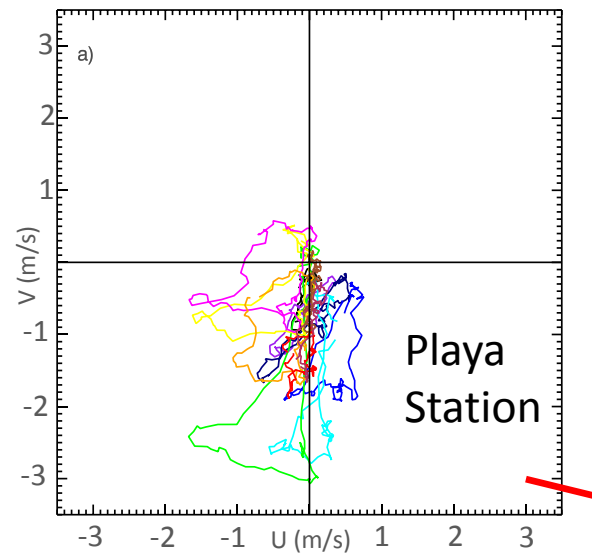
# Motivation

What wind forcings are relevant at a given time of day in a given month?

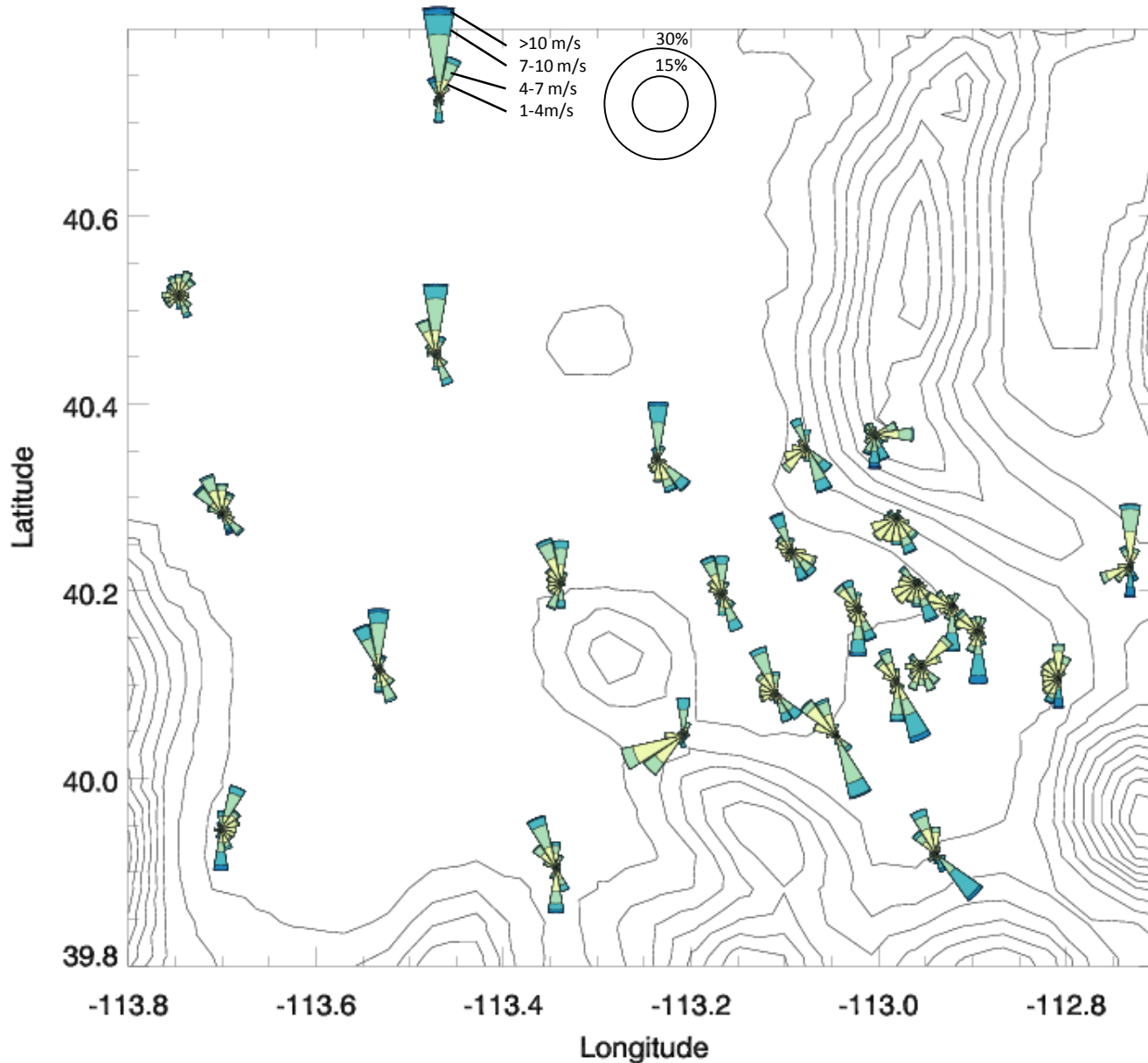
Does weak upper level flow= quiescent conditions?

What phenomena are important (valley flows, regional circulations, etc)?





# Bimodal Wind Distribution



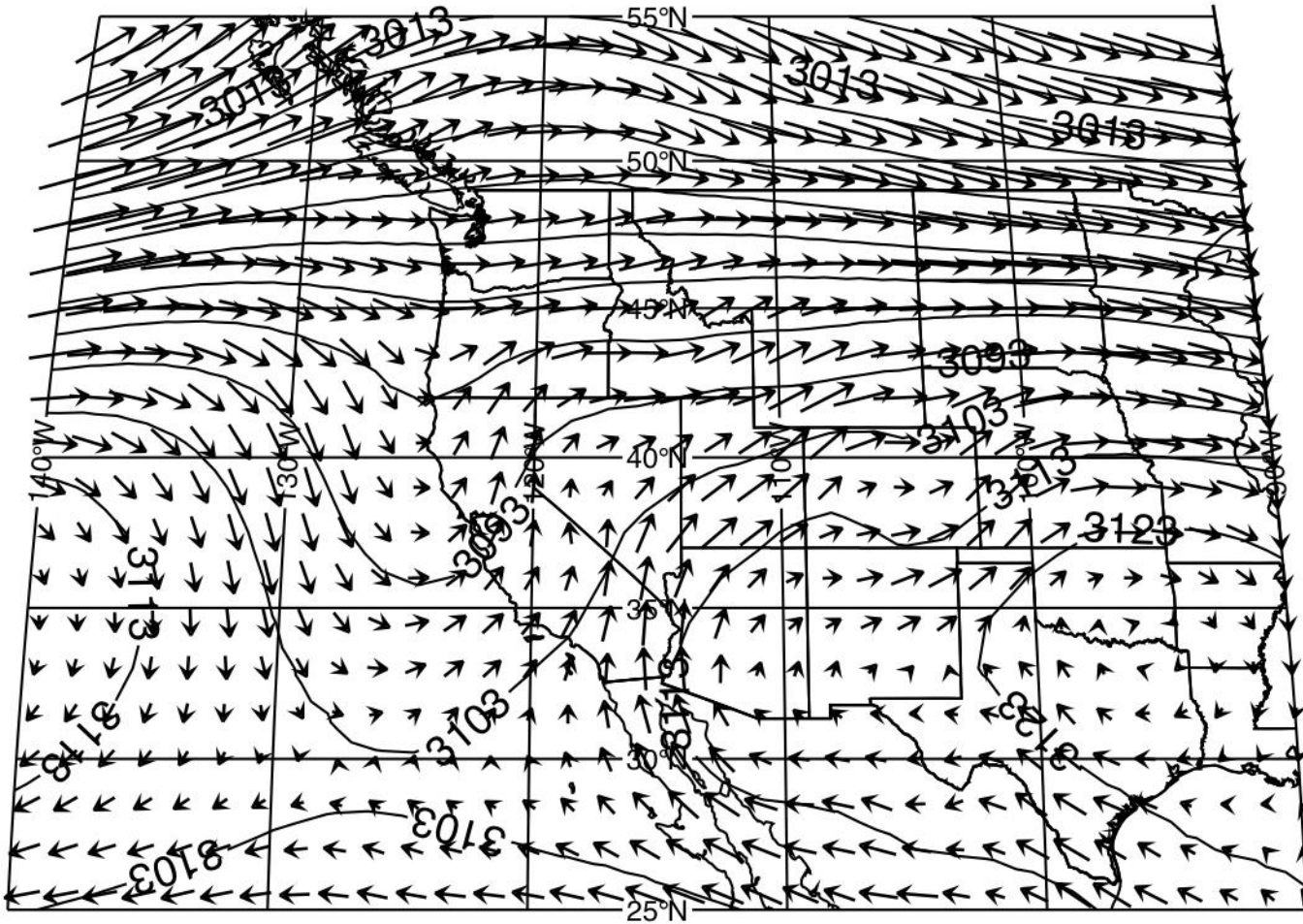
Wind rose map for DPG during the morning transition period in June. ~10 years of data is included.

Winds show a strong bimodality at most stations.

If one station is northerly, it is likely that all are and vice versa.

Flow aligns with topography.

# August Composite of Northerly Surface Winds



ERA-Interim Aug 12Z  
Composite 700 mb  
height (contours)  
and wind (vectors).

Northerly winds  
obviously aren't  
mixing down from  
the 700 mb flow!

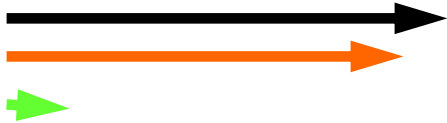
# Review of Thermal Wind

700 mb Geostrophic Wind

Thermal Wind Vector

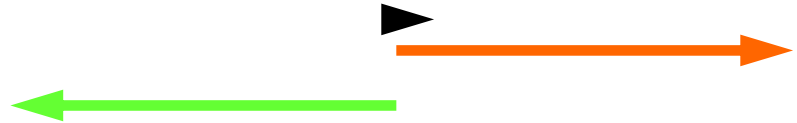
Surface Geostrophic Wind

Low Pressure @ 700 mb and Cold



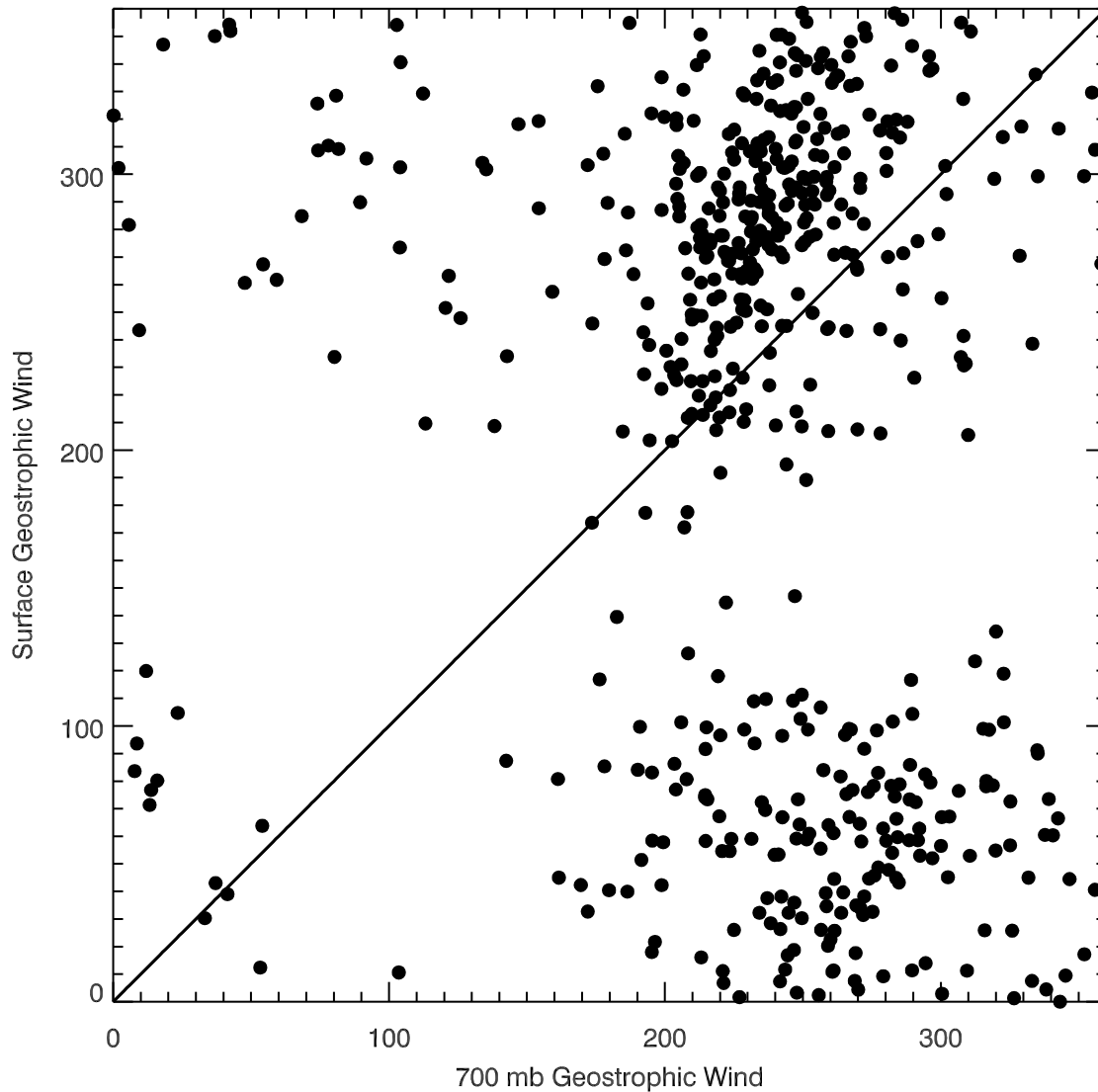
High Pressure @ 700 mb and Hot

Cold



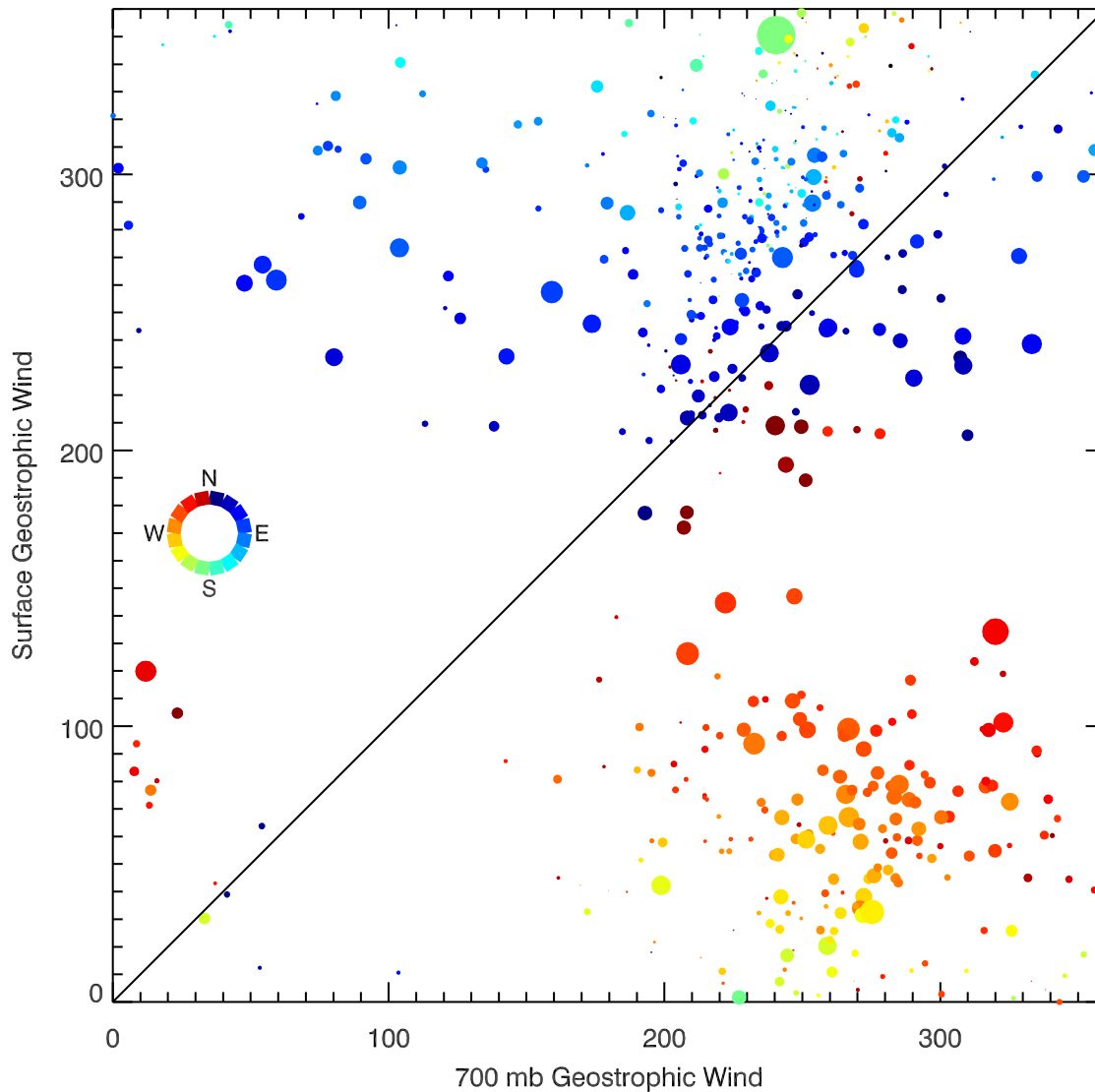
Hot

# Importance of Temperature Gradients



Black dots represent  
15 years of daily data  
at 1700 MST in  
August.

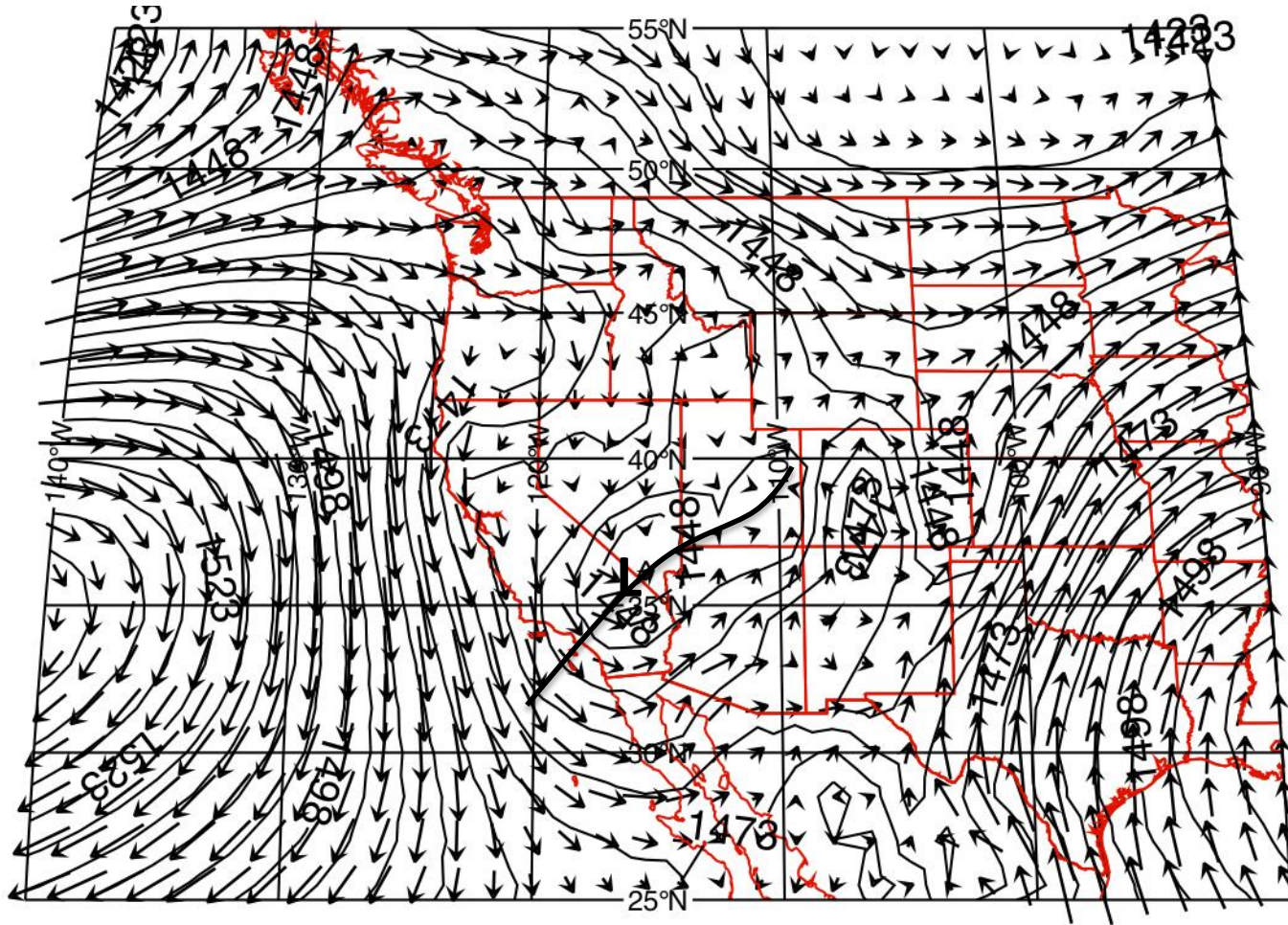
# Importance of Temperature Gradients



Dots represent 15 years of 12-hourly reanalysis data. Color-coding indicates the direction of the thermal wind vector, dot size indicates the relative magnitudes of the thermal wind vectors.



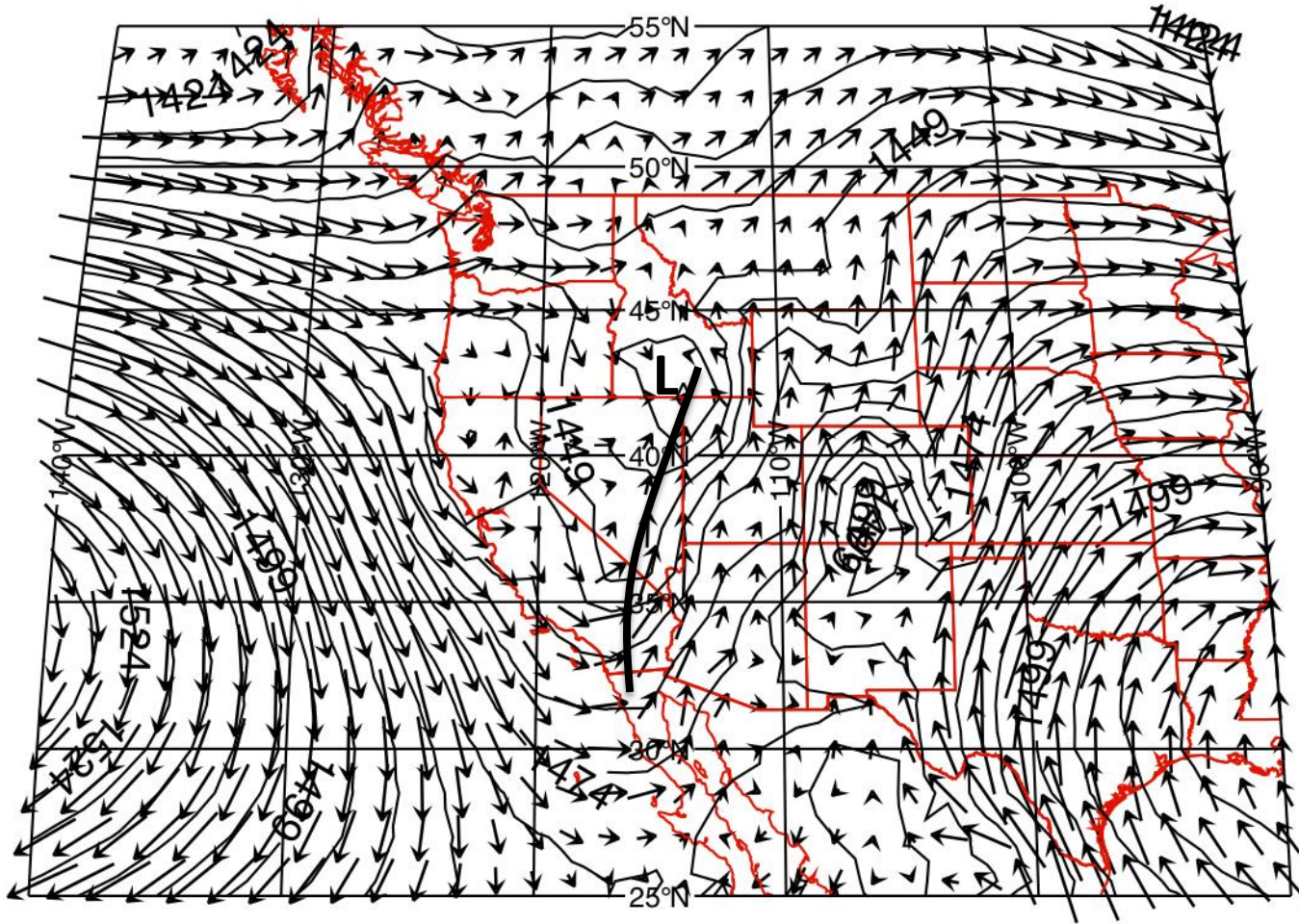
# Northerly Regime – 850 mb



ERA-Interim June  
12Z Composite 850  
mb height (contours)  
and wind (vectors)

N=283

# Southerly Regime – 850 mb

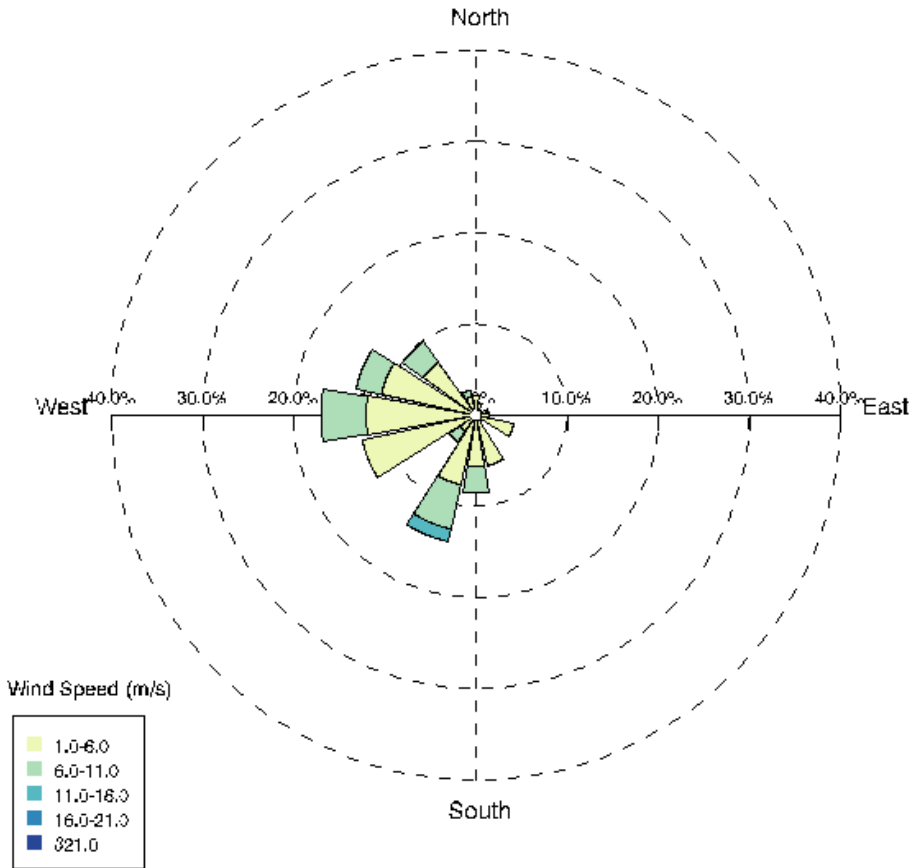


ERA-Interim June  
12Z Composite 850  
mb height (contours)  
and wind (vectors)

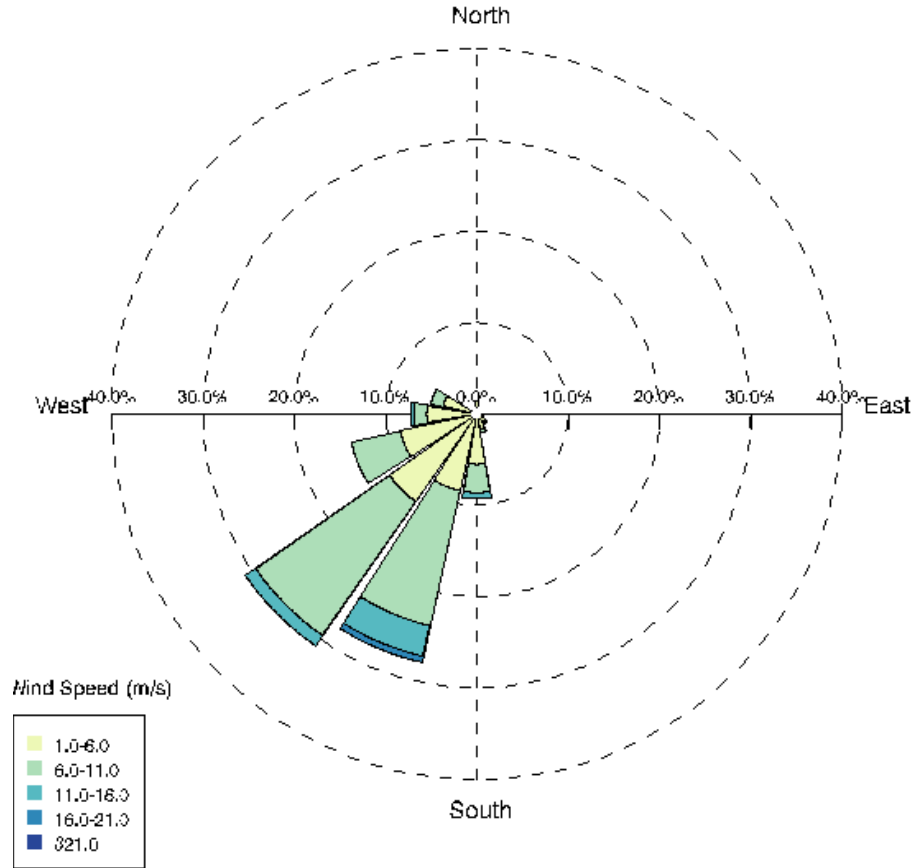
N=191

# Potential Lee Troughing?

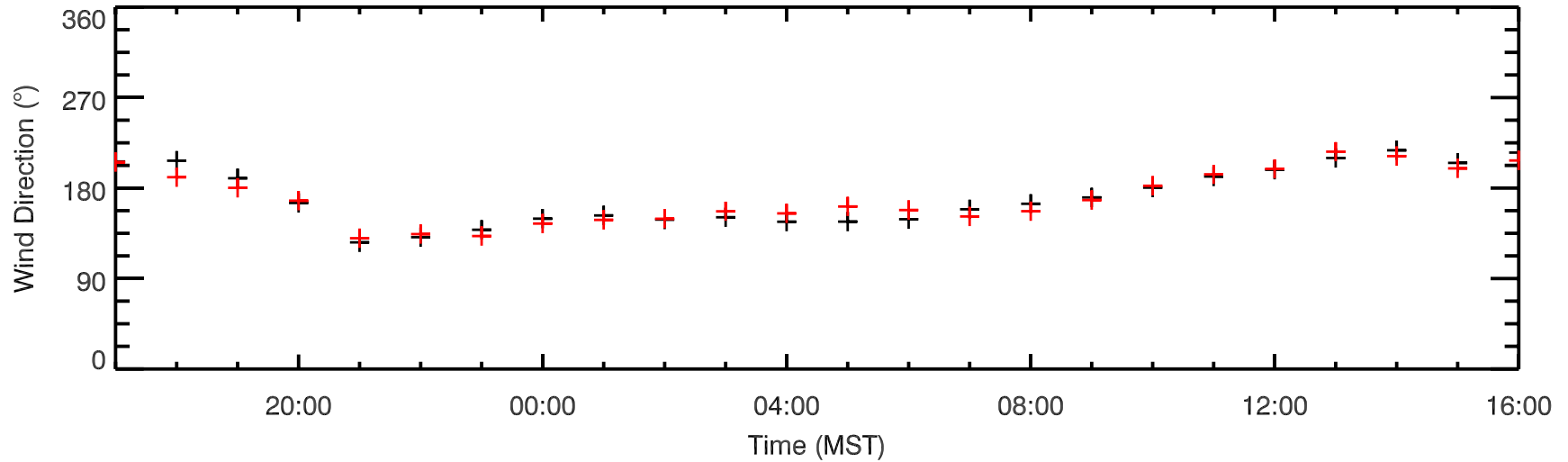
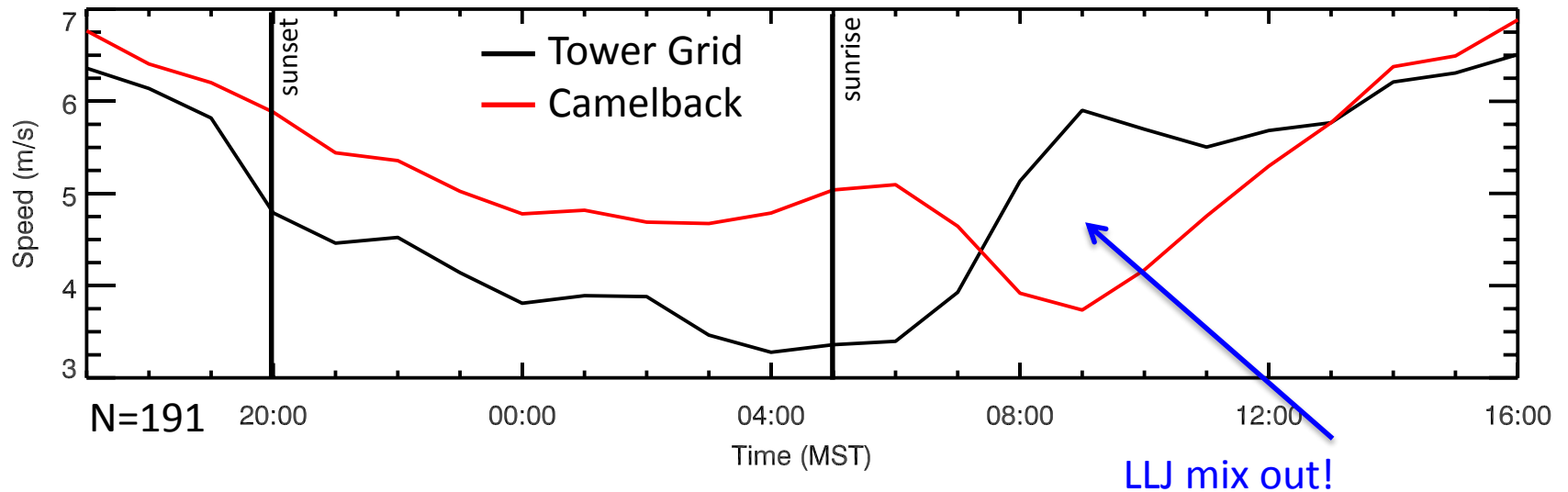
## Northerly Regime - Aug



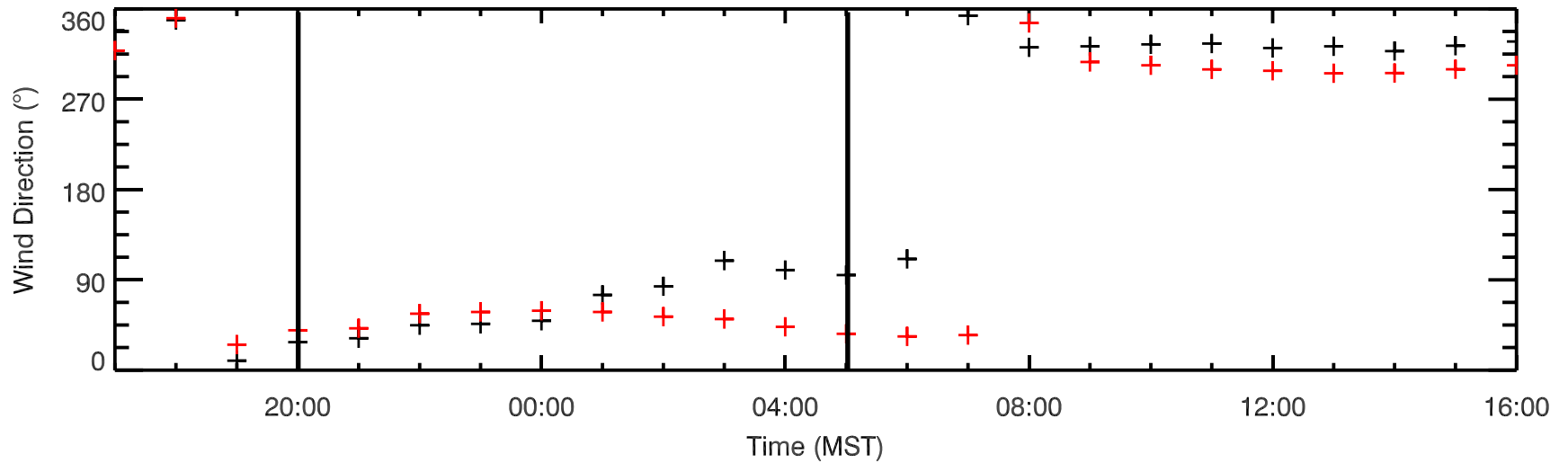
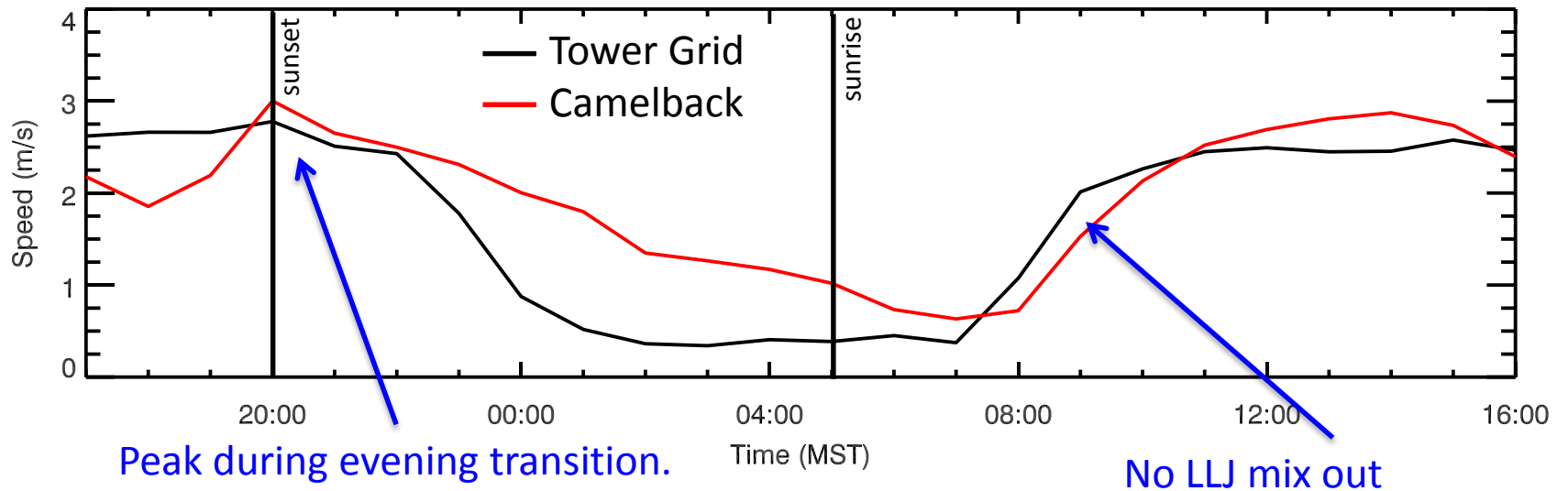
## Southerly Regime - Aug



# Mean Wind – June Southerly Regime

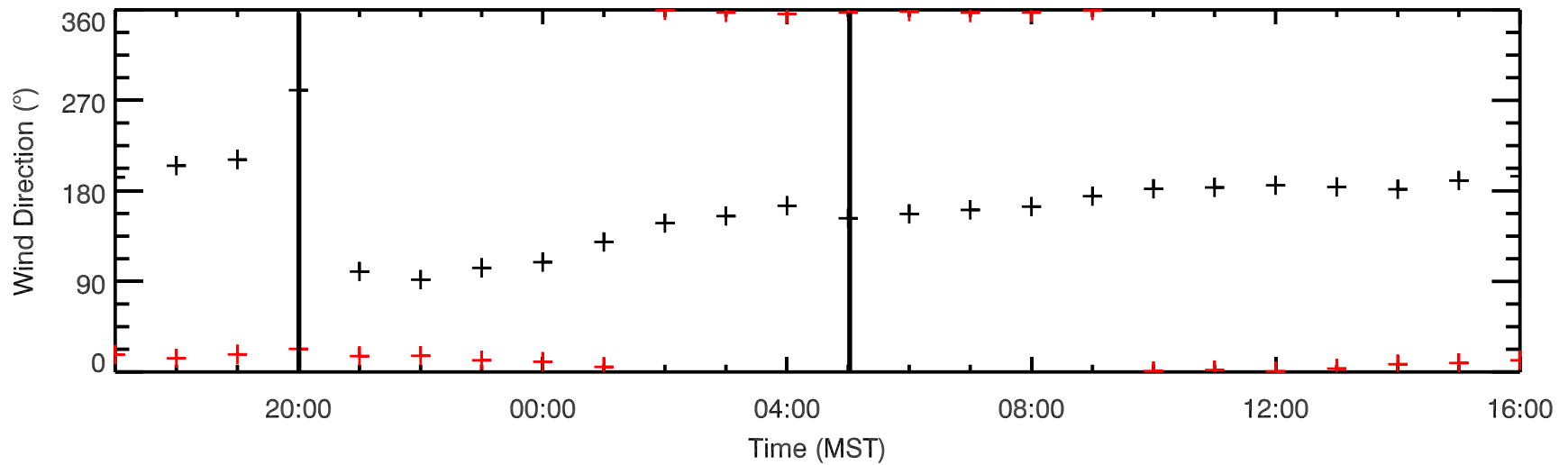
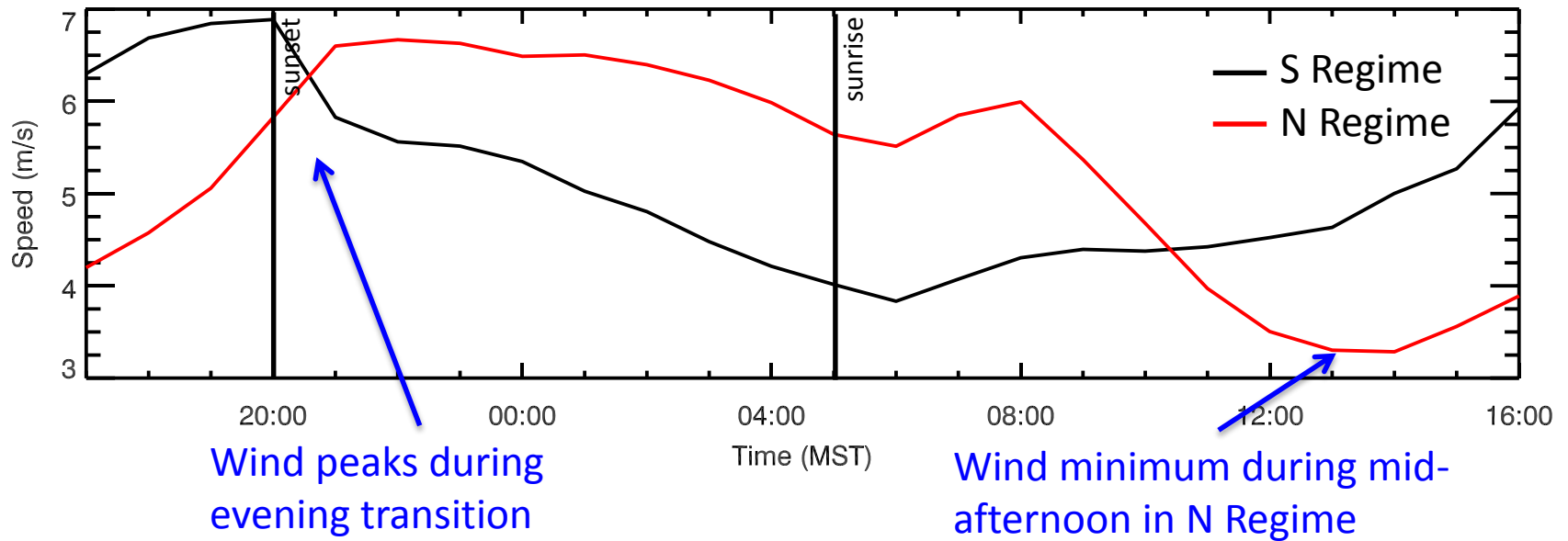


# Mean Wind – June Northerly Regime



N=283

# Mean Wind – Playa Station



# Conclusions

- All areas of Dugway have significant channeling of the large-scale flow, leading to difficulty attributing the wind to a given forcing.
- Even in summer, lee troughing may be a significant factor.
- Synoptic and mesoscale temperature gradients heavily influence the surface flows and should be carefully considered as part of defining “quiescent” or strongly forced events.
- The Playa sites are largely synoptically influenced.
- Sagebrush area sites are a mix of local and synoptic, with sites closest to Ditto being most influenced by local terrain.