

Analysis of Ramp Events and Two-Day Persistence Forecast Accuracy at 80 m

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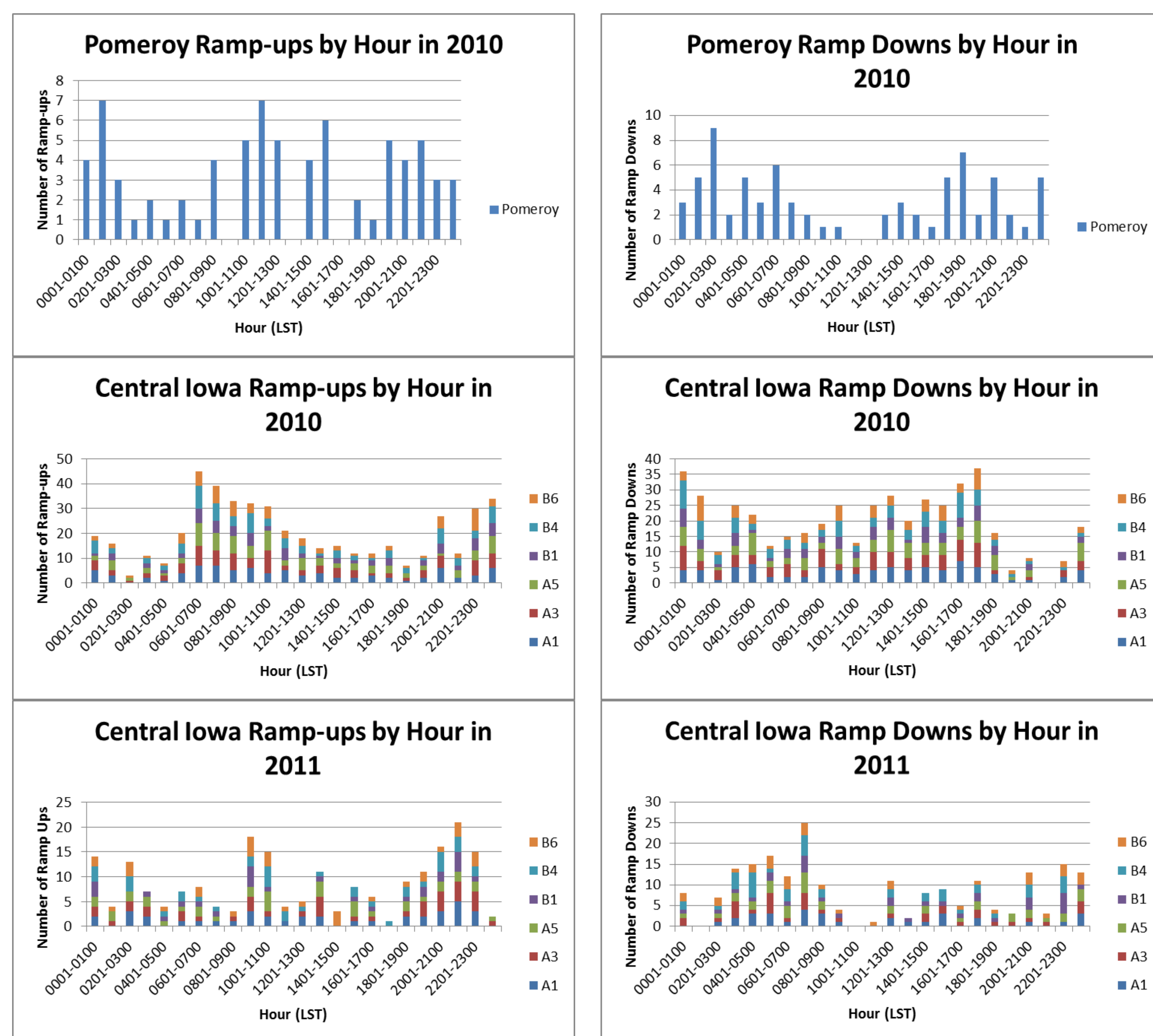
Introduction

Ramp events cause sudden, unexpected changes in power output at a wind farm. Mapping the behavior of these events and determining a meteorological cause can help forecasters make wind energy more efficient.

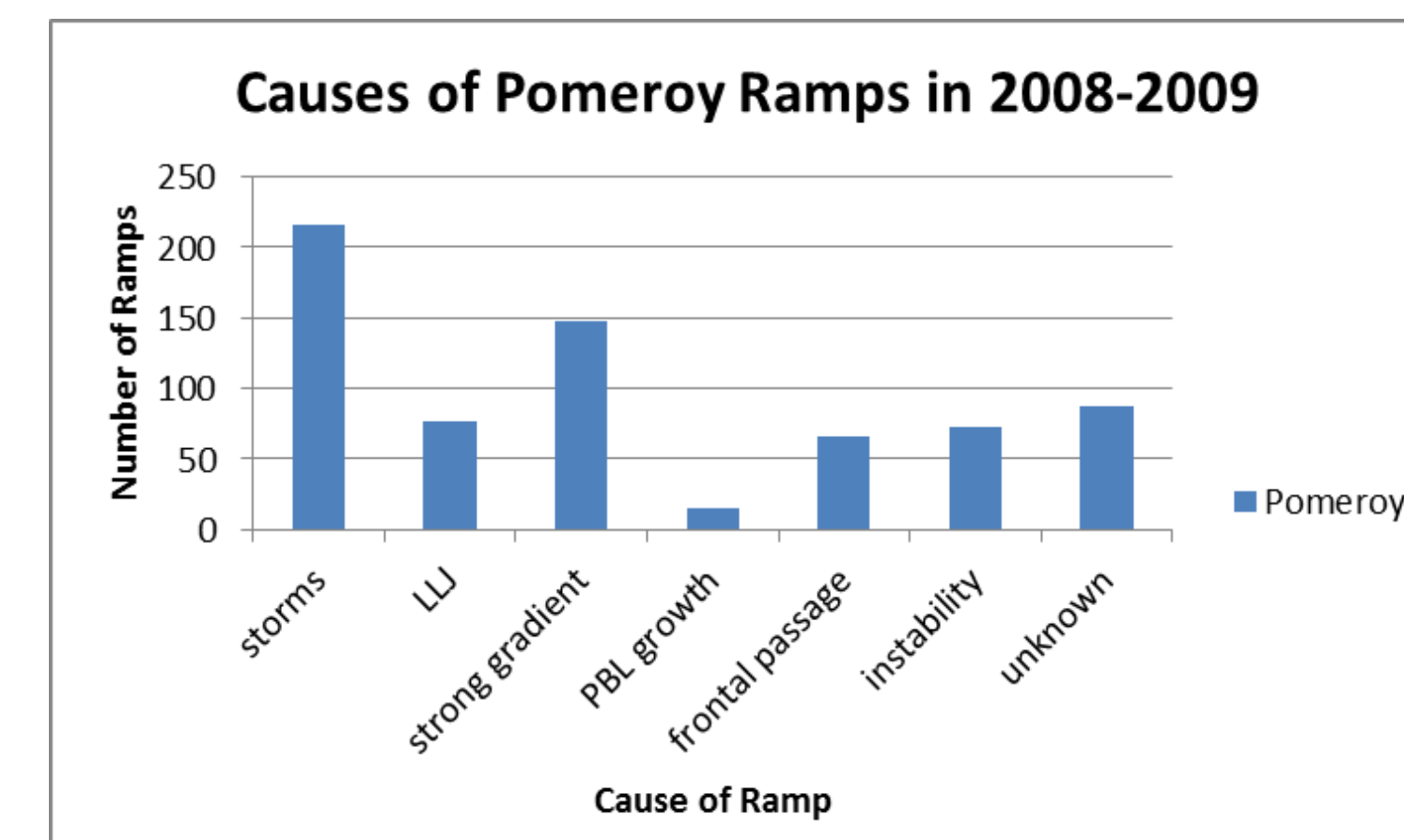
Data and Methodology

Wind speed data was analyzed from an 80 m meteorological tower in Pomeroy, IA from 2008-2010 and from six turbines at a central Iowa wind farm from 2010-2011 to find ramp events defined as a 3 m s^{-1} change in wind speed in 4 hr or less (Deppe et al., 2012).

Results



Initial results comparing the timing of ramp-ups in Central Iowa and in Pomeroy, IA show little correlation. Both sites do show an increase in ramp-ups around 2000-0200 local standard time (LST). This is likely due to the presence of the nocturnal low level jet. Ramp downs show a peak around 0100-0300 LST and 1700-1800 LST.



The Iowa Environmental Mesonet and Iowa State University Meteorological Archive Data Server were used to determine a meteorological cause of the observed ramp events. Storms and strong pressure gradients were found to be the most likely cause. More work is in progress to add data from 2010-2011 and to determine whether ramps occur at a certain threshold of mesoscale forcing.

Pomeroy Persistence Forecast	
Hits	52
Misses	76
False Alarms	79
Forecasted Ramps	207
Observed Ramps	150
Hit Rate	0.3467
False Alarm Rate	0.3816
Threat Score	0.1837

This table shows the results of a two-day persistence forecast. This sort of forecast is used by wind energy companies as a measure zero-skill. In knowing how well this “zero-skill” forecast performs, we can improve current forecasting methods. This forecast performed well considering it assumes conditions two days prior will continue, but should not be relied upon for accurate wind speed forecasts as it only predicts ramp events 34.67% of the time. A persistence forecast for Central Iowa is in progress.

References

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