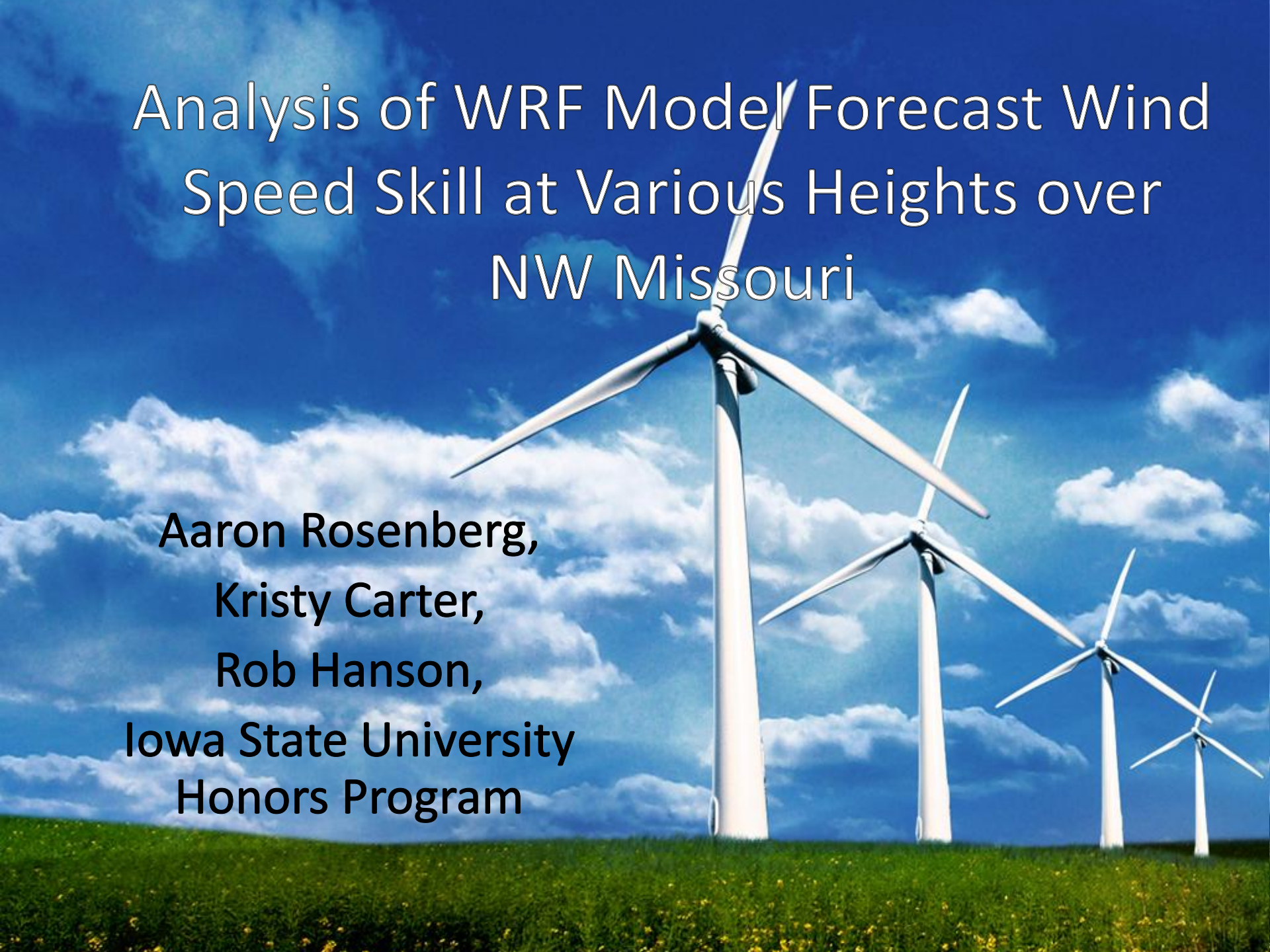
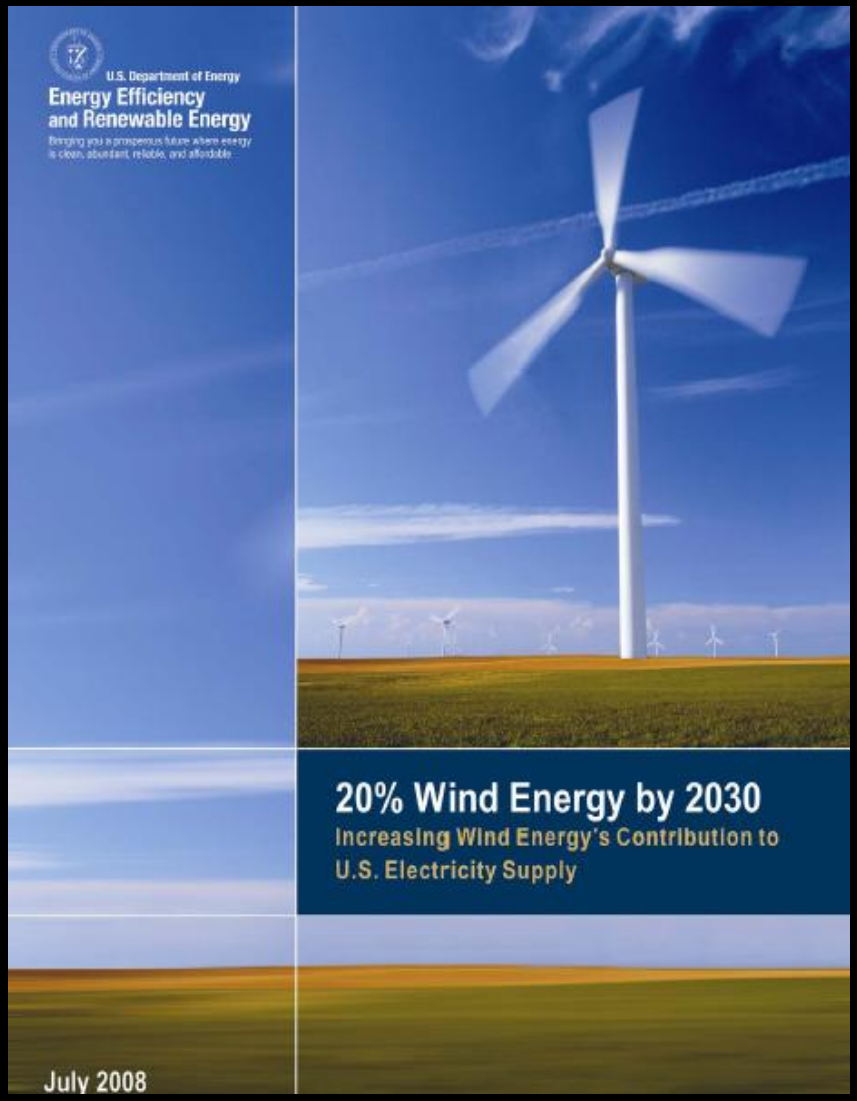
Analysis of WRF Model Forecast Wind Speed Skill at Various Heights over NW Missouri



Aaron Rosenberg,
Kristy Carter,
Rob Hanson,
Iowa State University
Honors Program

Objective

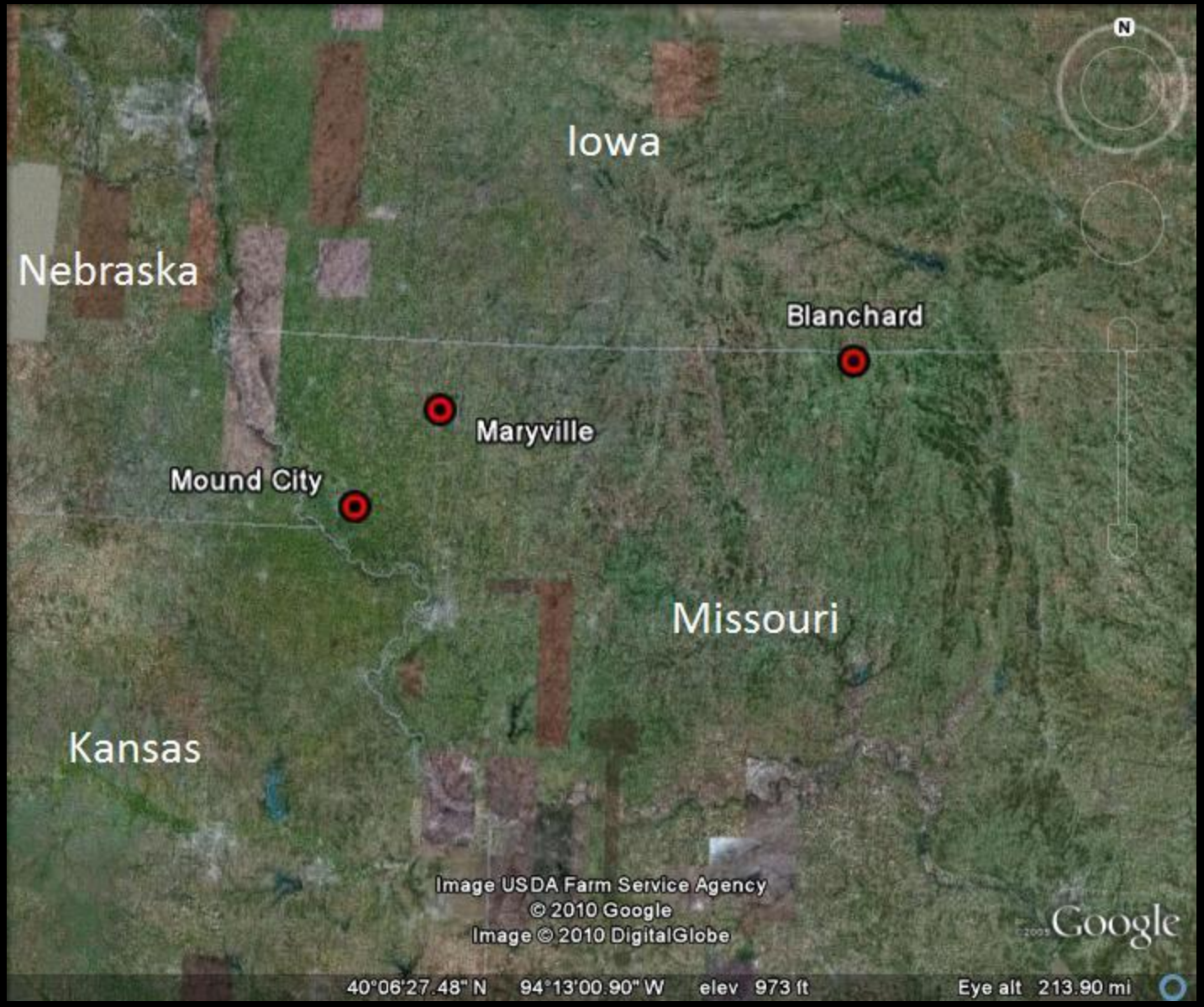


- US DOE goal: 20% wind by 2030
- Difficulty forecasting wind speed
- Model improvements needed for meeting this expansion of wind power

Data

- Wind data provided by University of Missouri
- Three Towers
  - Blanchard, MO
  - Maryville, MO
  - Mound City, MO
- 10 minute intervals
- 4 Heights (67m, 97m, 117m, 137m)
  - Anemometer sensors on NW and SE sides of mast

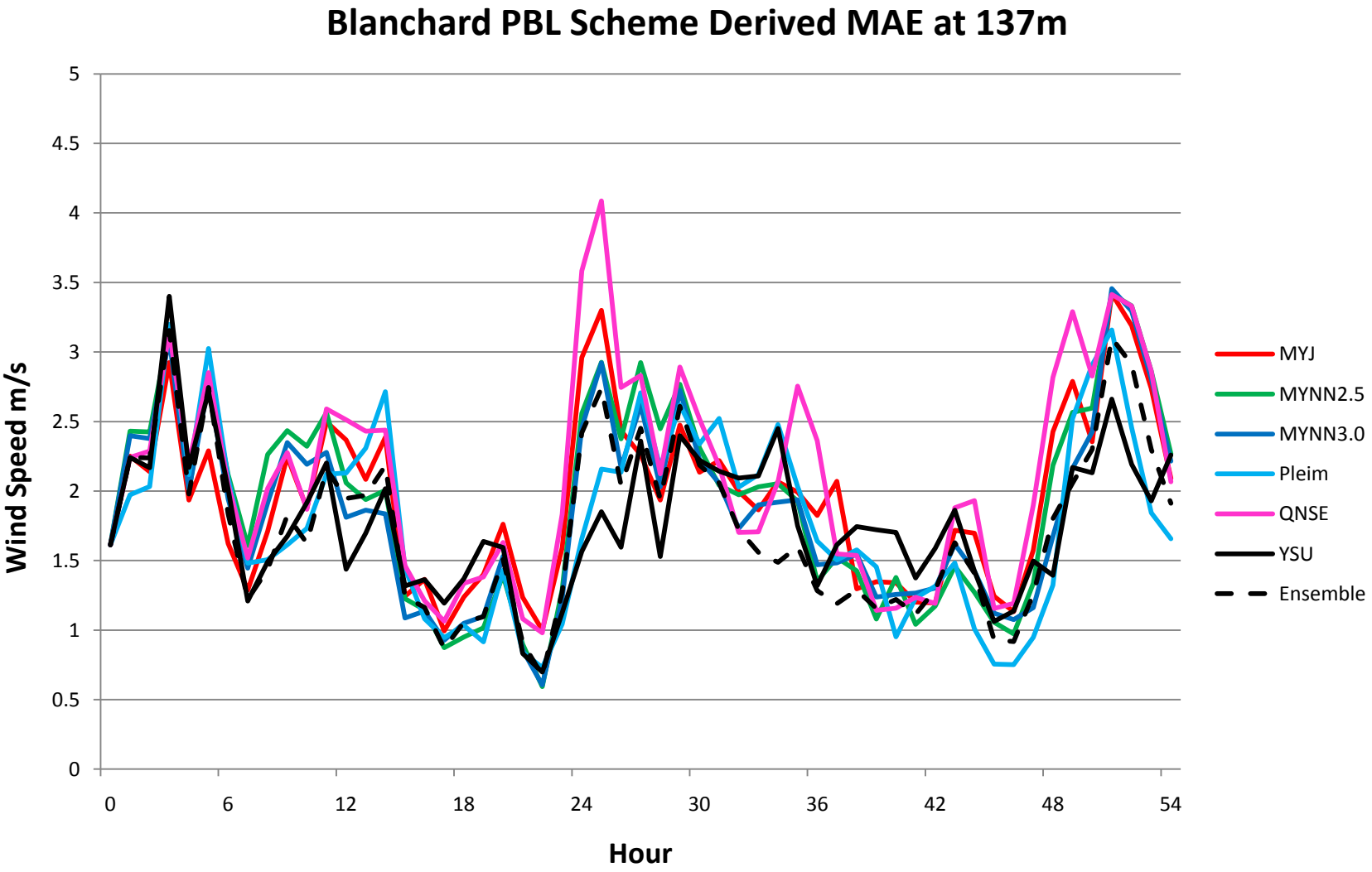
Location of Towers



Methodology

- Averaging of 10 minute intervals to fit hourly model data
  - Highest value of anemometer wind speed used
- WRF model data collected 10 cases
  - April 1, 2009 to April 12, 2009
  - 54 hour forecast periods
  - Model initialized at 0 UTC (6pm LST)
  - 6 PBL schemes chosen
- Calculated MAE over 10-day averaged forecast period
  - Compared PBL schemes and ensemble mean

Sample MAE Plot



Results

- Peak/lowest MAE among all schemes 7pm/4pm LST
  - Consistent along day/night transitional PBL scheme behavior
- MAE in Maryville increases as height increases while Mound City MAE stays relatively constant
- No real pattern followed between MAE day one and that of day two for Blanchard and Maryville
- Mound City day two MAE consistently lower than day one
- Blanchard MAE, significantly lower than MAE of other sites

Summary

- Much uncertainty exists among simulated PBL behavior, especially during transition times
- Ongoing study will require further analysis of additional weather events and how they impact model skill
- Reliable data sources and continuity of observation characteristics needed to improve understanding of wind climatology

Acknowledgments

- Dr. Eugene Takle, Dr. Bill Gallus and Ph.D. student Dan Rajewski for guidance and support
- Adam Deppe (M.S. Student) for providing the model data and for helping with analysis
- University of Missouri (Neil Fox) for providing the observations
- Partial funding was supplied by NSF grant BCS0618823, DOE grant #13-450-141201, Ames Laboratory Project 290-25-09-02-0031, and PSERC grant#400-60-12