

# **Initial Assessment of Wind Profile Predictability at STL**

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# Outline

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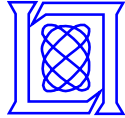
- **Introduction**
- **Data sets**
- **Profile prediction algorithm**
- **Results**
- **Summary**



# Introduction

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- **Question: How well can we predict when the crosswind profile will stay favorable?**
  - To what altitude?
  - With what crosswind thresholds?
  - We don't really have the data required to answer this question
- **Initial question: Does it appear likely that we will be able to predict when the crosswind profile will stay favorable?**

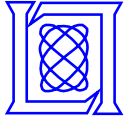


# Data sets

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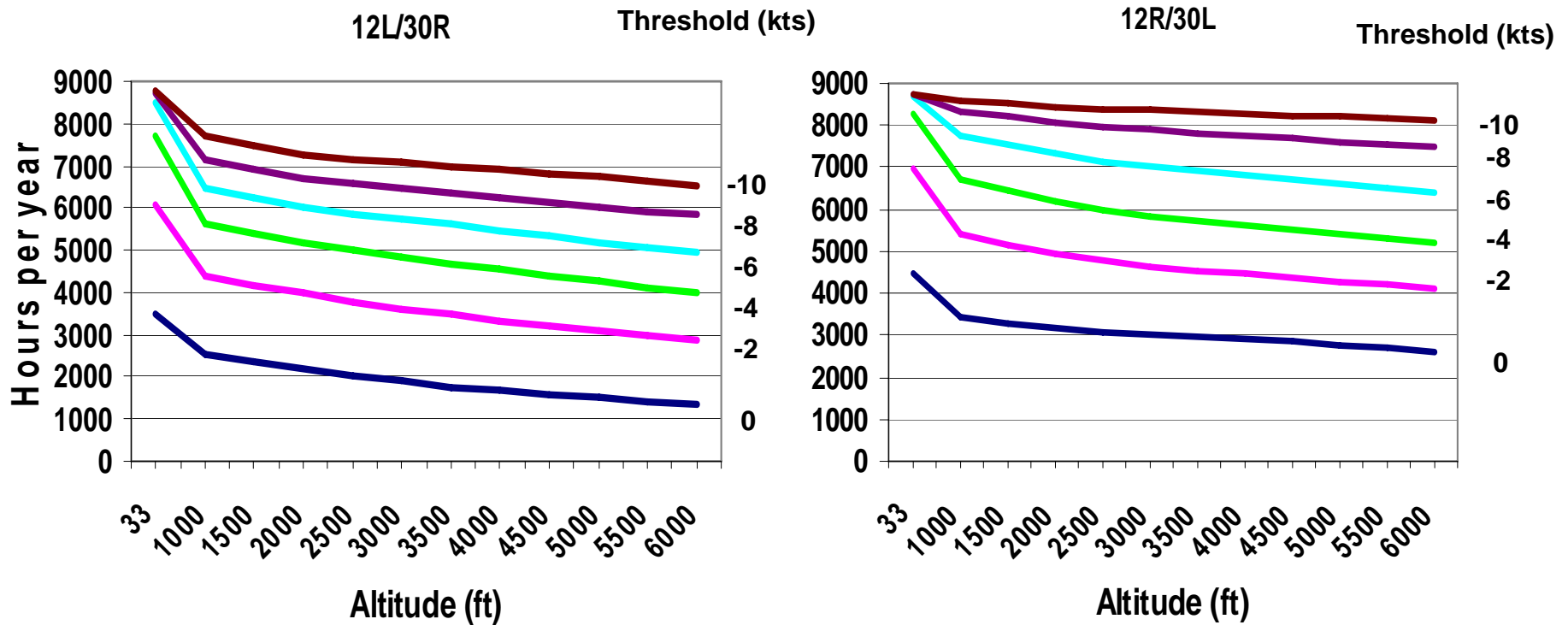
- **LLWAS surface winds: network of 10 anemometers spread at ~1 nmi spacing, 90 ft poles, 10 second update averaged to 2 minute mean winds**
- **RUC wind profiles\*: 19 levels from the surface to over 6000 ft, ~70 ft to ~700 ft vertical resolution, hourly**
- **ASOS\* wind and visibility: wind at 33 ft, 2 minute mean**
- **CTI VAD wind profiles: 200 ft – max of 5500 ft, vertical resolution 63 ft**

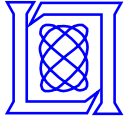
**\* Provided by Joe Sherry, MITRE**



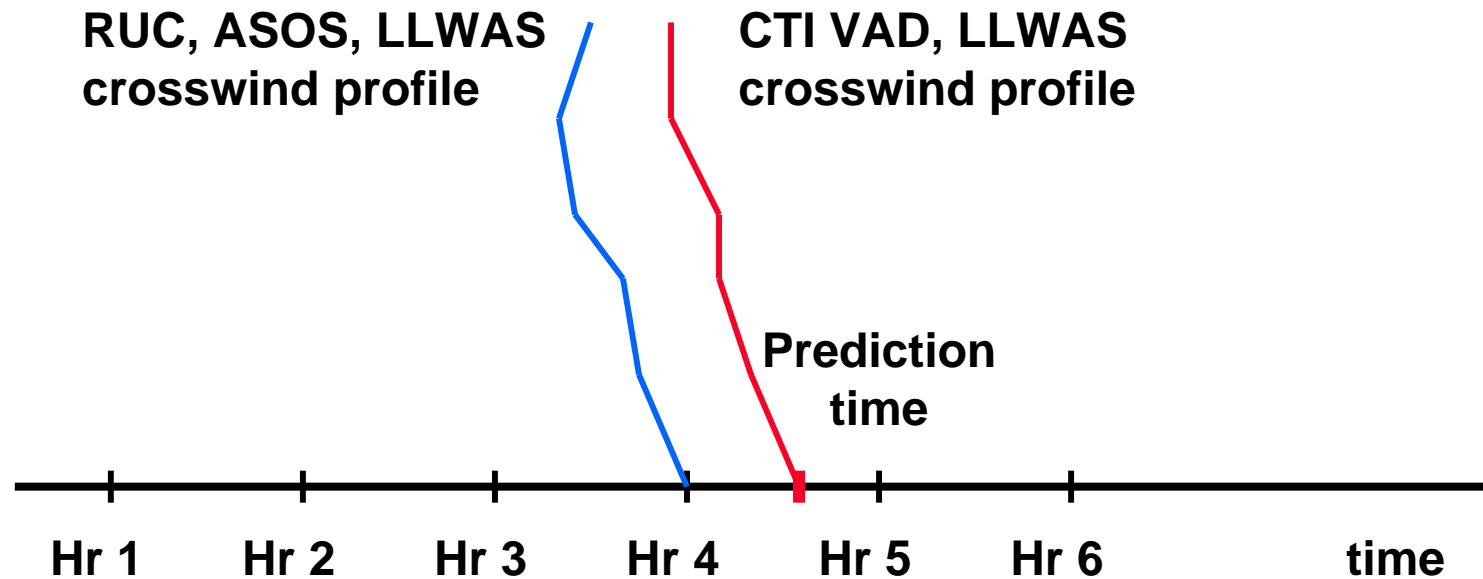
# RUC/ASOS Climatology

## Hours per year RUC/ASOS winds favorable by altitude





# Prediction algorithm

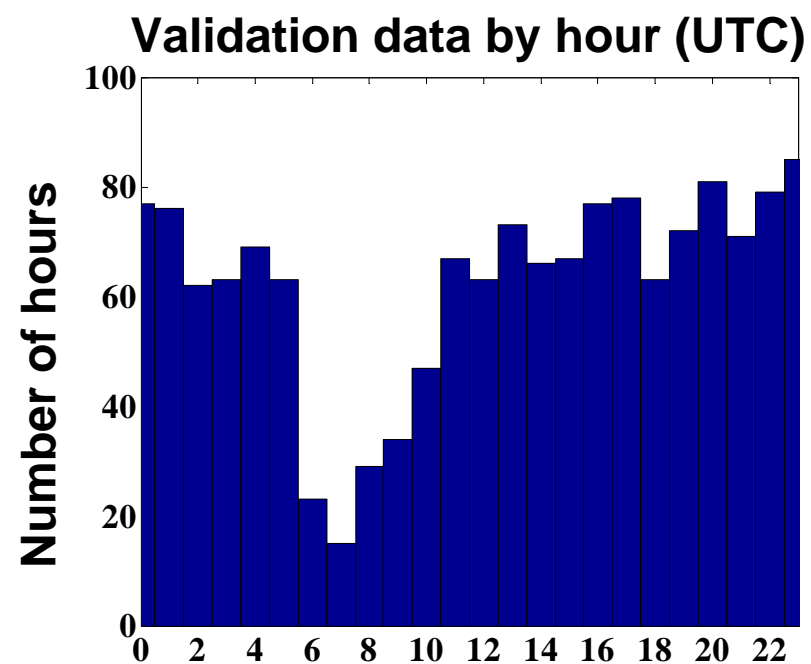
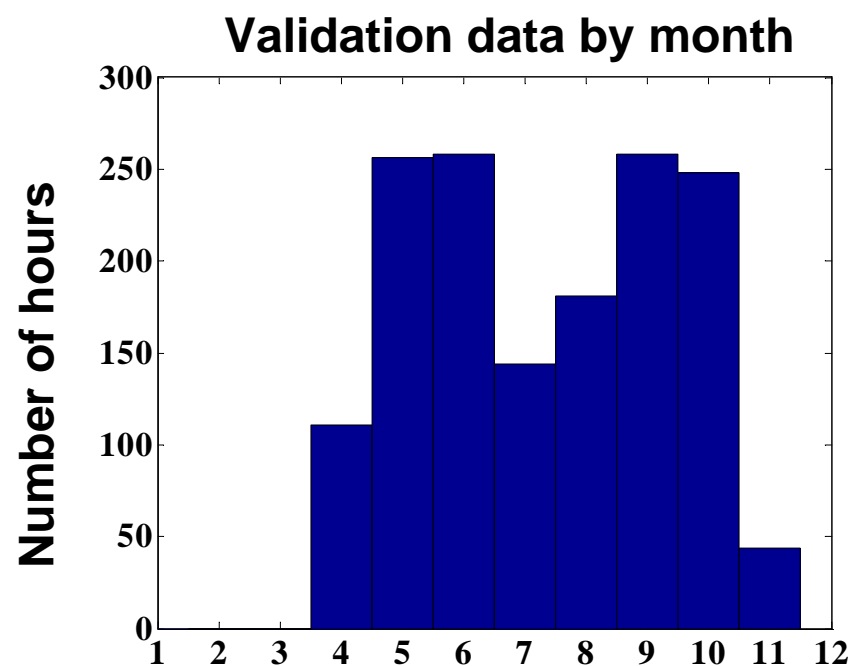


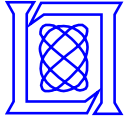
- If blue crosswind profile is greater than threshold + buffer,  
AND  
Current LLWAS network minimum crosswind is greater than  
threshold + buffer: Predict wind aloft favorable
- Validate against red profile



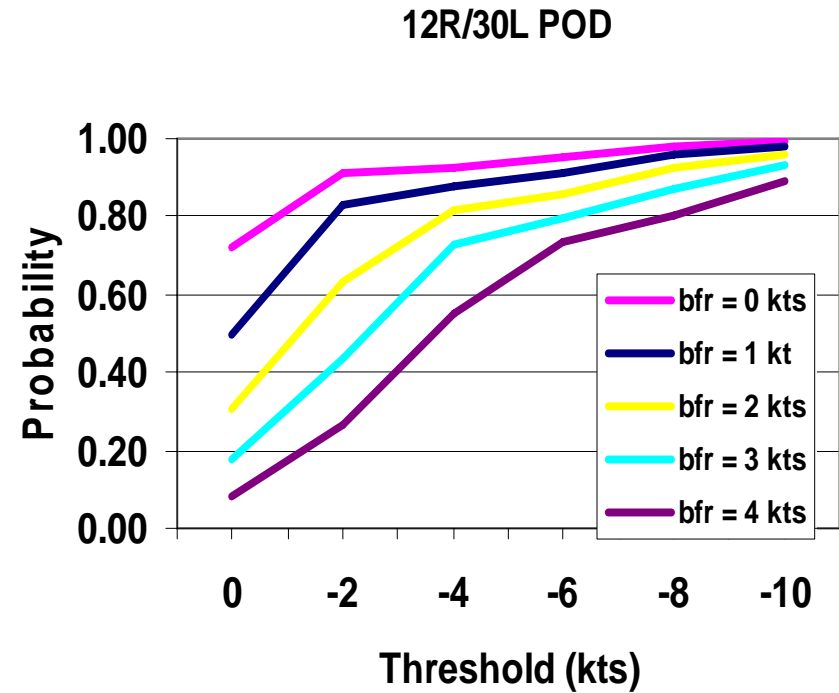
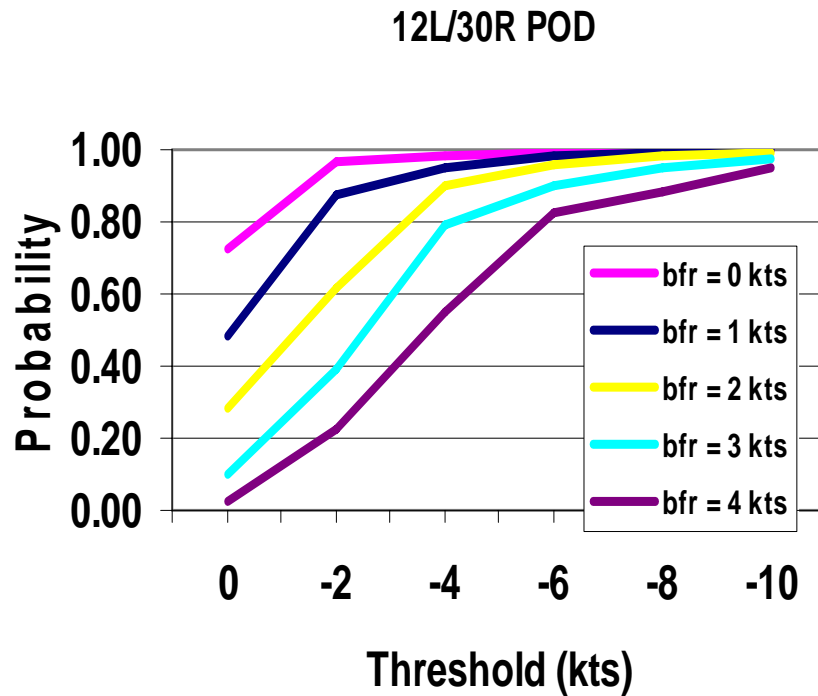
# Distribution of validation data

- RUC, LLWAS, and CTI VAD to at least 1000 ft
- 1664 total





# Results

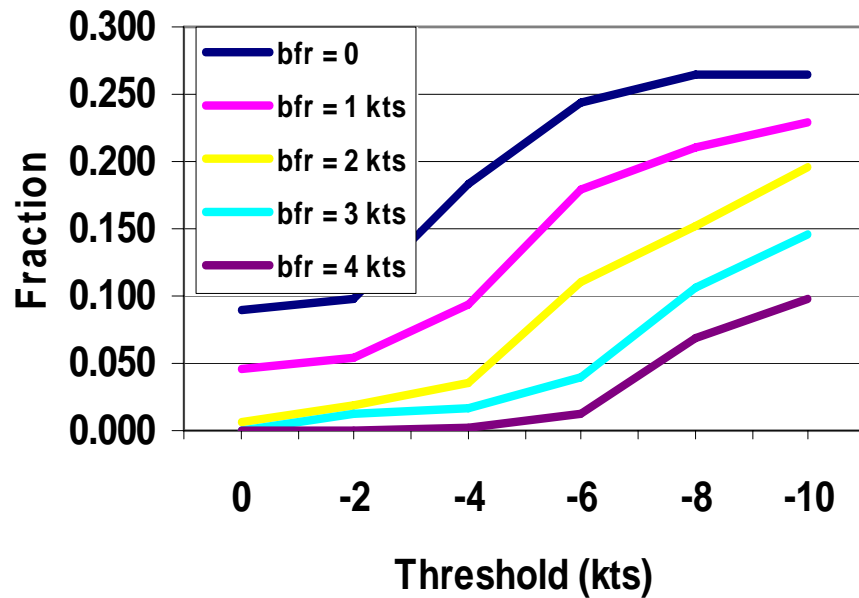


- Altitude to 1000 ft

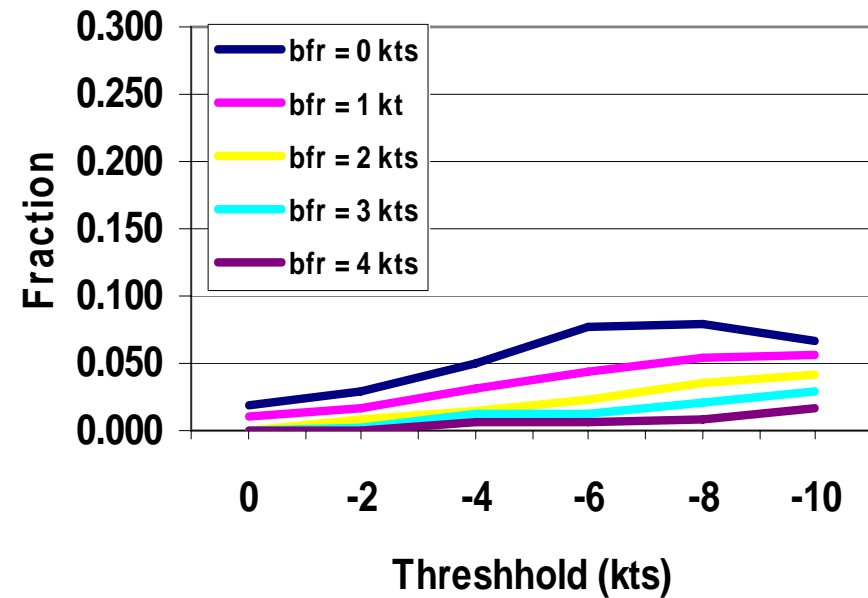


# Results

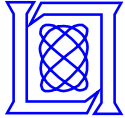
12L/30R type 1 errors vs threshold



12R/30L type 1 errors vs threshold

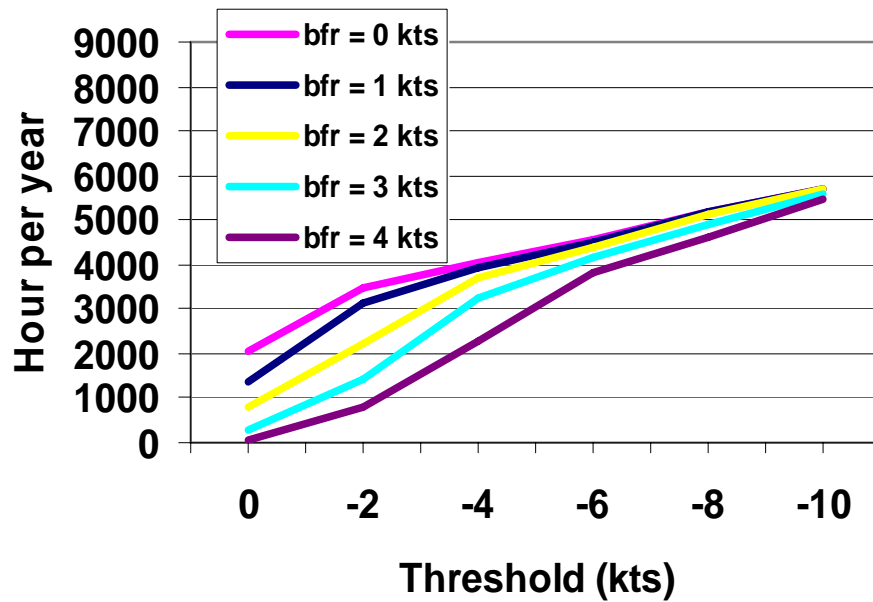


- Altitude to 1000 ft
- This is for a one hour prediction, mean validation time = 30 minutets

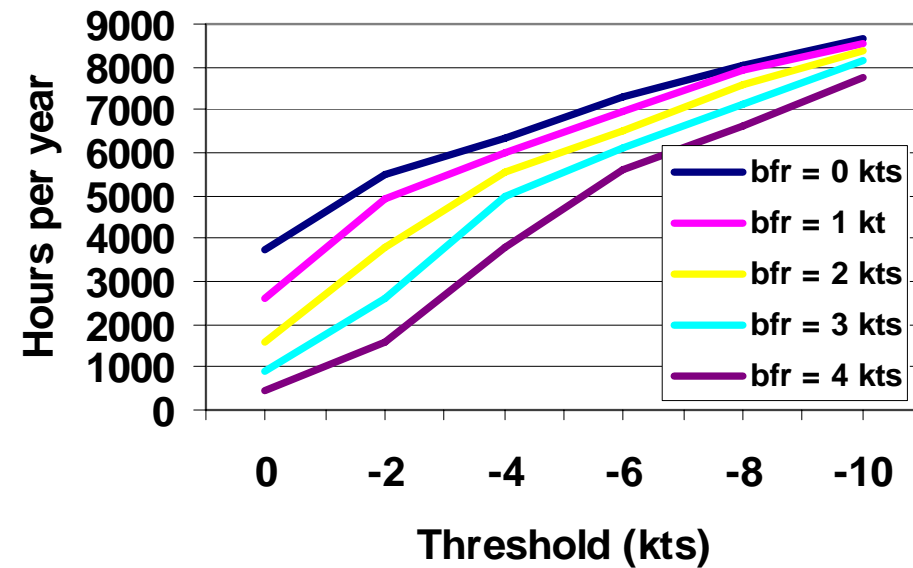


# Results

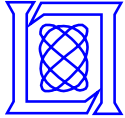
12L/30R hours/yr positive predictions



12R/30L hours/yr positive predictions

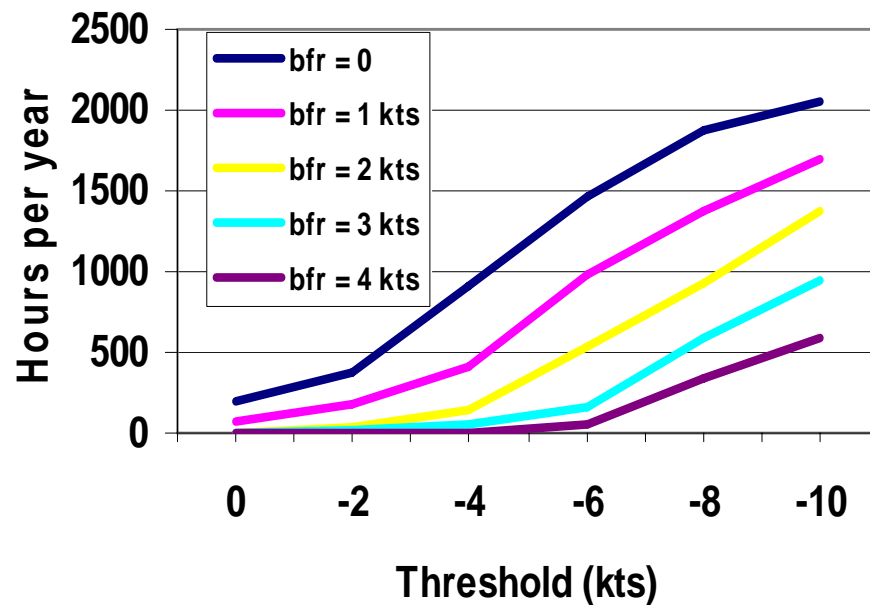


- Altitude to 1000 ft

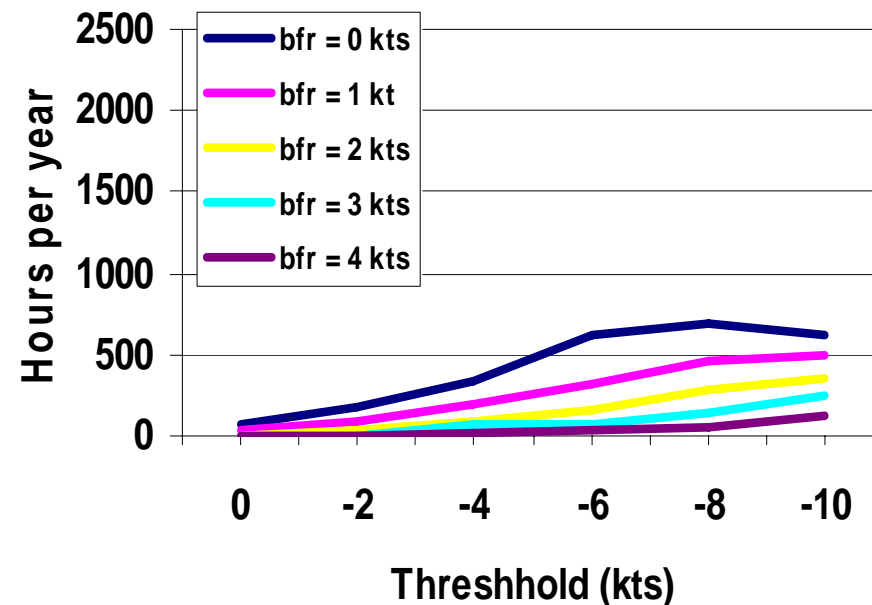


# Results

12L/30R type 1 errors vs threshold



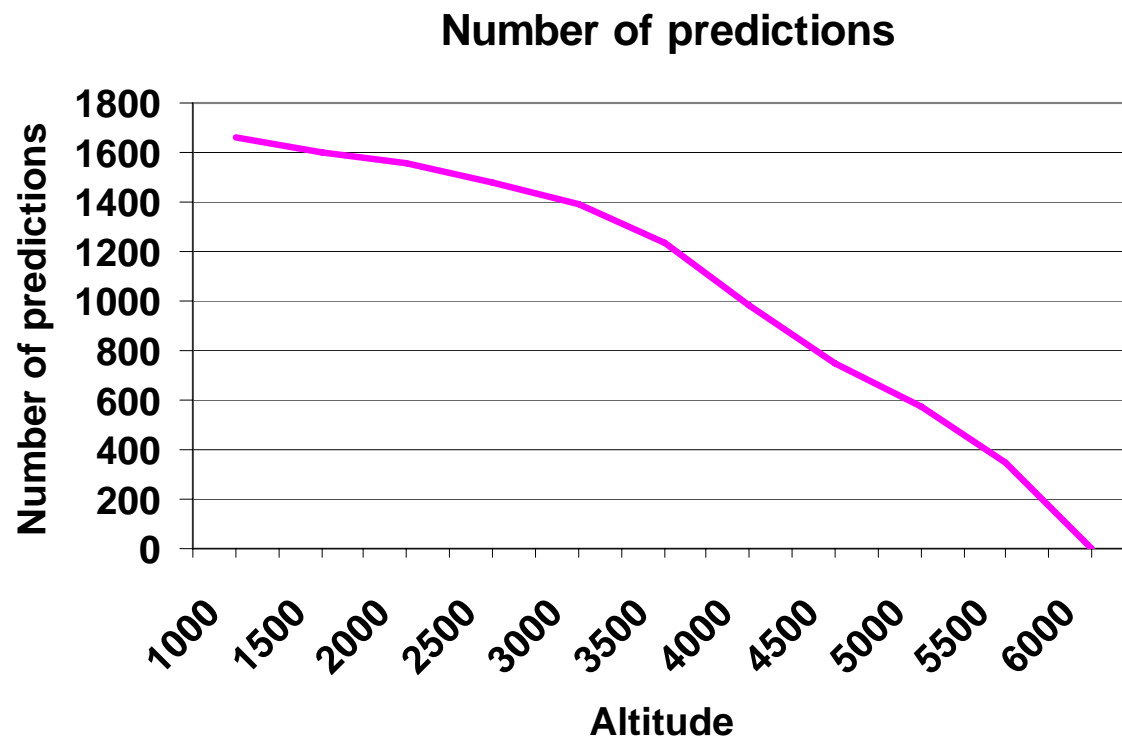
12R/30L type 1 errors vs threshold

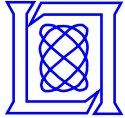


- Altitude to 1000 ft
- Some unknown number of prediction errors due to VAD errors

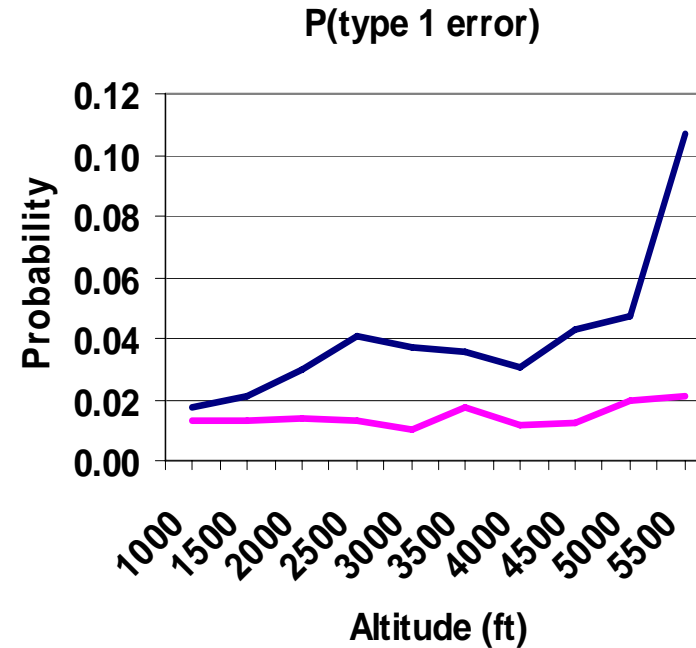
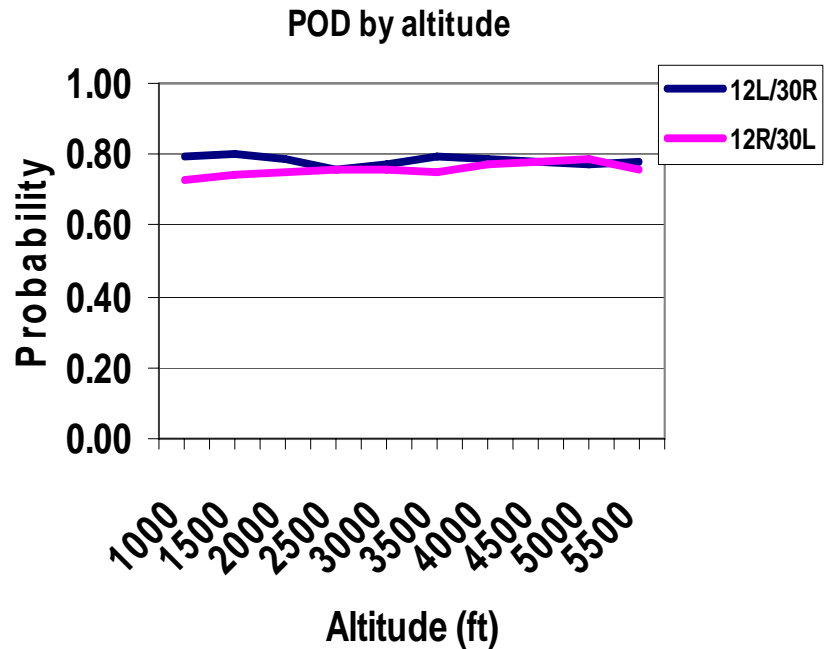


# Distribution of validation data by altitude

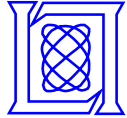




# Results



- **Threshold = -4 kts**
- **Buffer = 3 kts**
- **Caveat: higher altitudes have very few data points**



# Summary

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- **There are many time periods with favorable crosswinds aloft**
- **A simple prediction algorithm shows the prediction problem is likely to be tractable**
- **The 12R/30L side has the greater benefit and easier prediction problem**
- **Larger data sets needed to refine algorithm**
  - **Both wind and weather data**
  - **Longer time periods and more rapid update**
  - **Data quality editing process for VAD**