Coherence of rainfall propagation as simulated in the WRF model using two different convective schemes

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Overview

- Introduction
- Motivation
- Data and Methodology
- Results
- Conclusions

Introduction

- Carbone et al. (2002)
  - Coherent propagating rainfall patterns
- Davis et al. (2003)
  - Models couldn’t produce these patterns
  - Blames cumulus parameterization

Introduction

- Liu et al. (2006)
  - High-resolution MM5 w/out convective scheme did better than coarse resolution MM5 w/convective scheme
  - Betts-Miller (BM) performed better than the Kain-Fritsch (KF) convective scheme

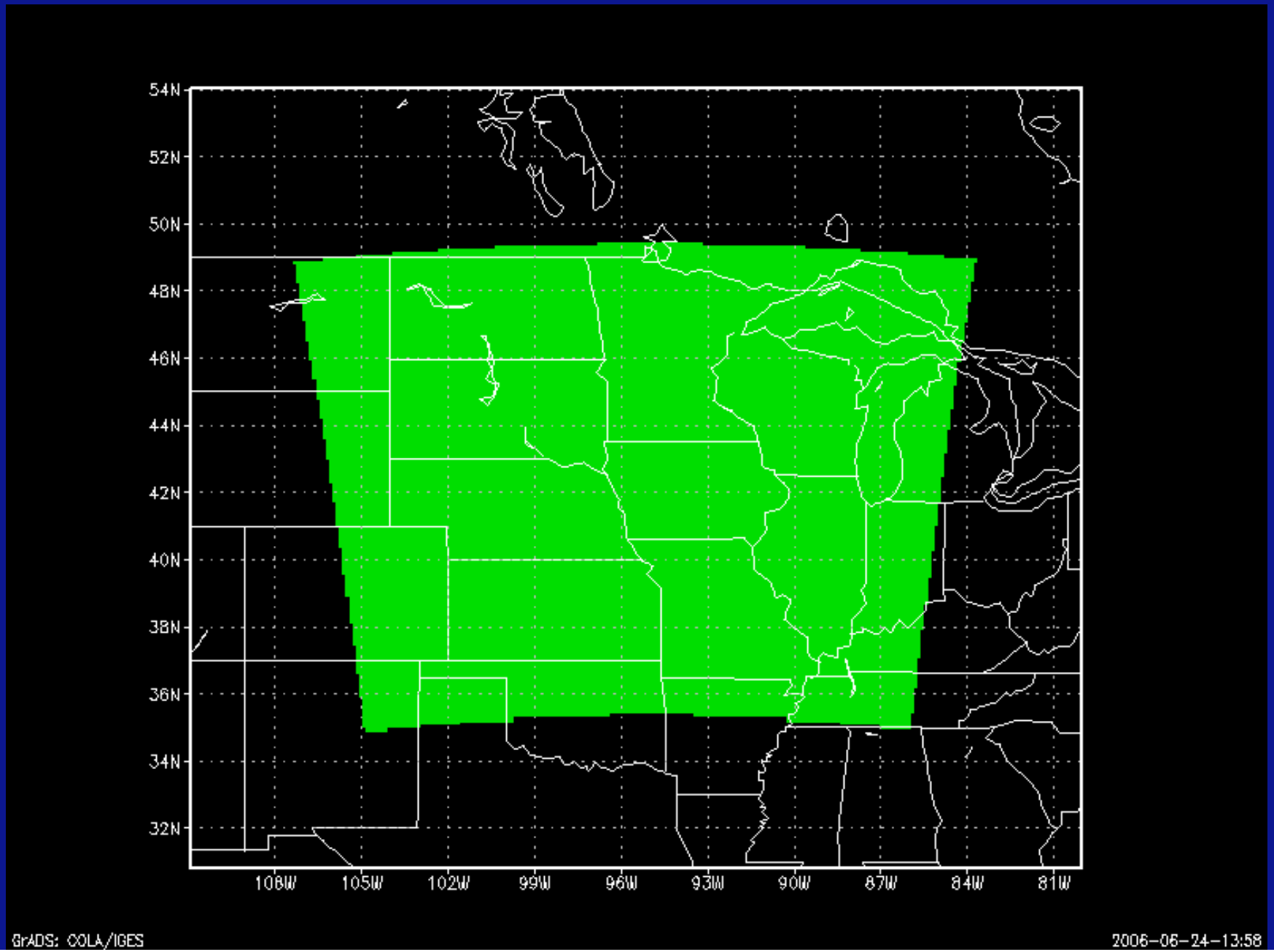
Motivation

- **Are there propagating convective precipitation events?**
- **Can we identify the errors in the cumulus parameterization?**

Hypothesis

- **The Betts-Miller-Janjic (BMJ) convective scheme will have less variability in duration and propagation speed than the Kain-Fritsch (KF) convective scheme compared to observations (Obs) because it relies on moisture in the column rather than vertical velocities to begin precipitation.**

Data


54N
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34N
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108W
105W
102W
99W
96W
93W
90W
87W
84W
81W
GrADS: COLA/IGES
2006-06-24-13:58

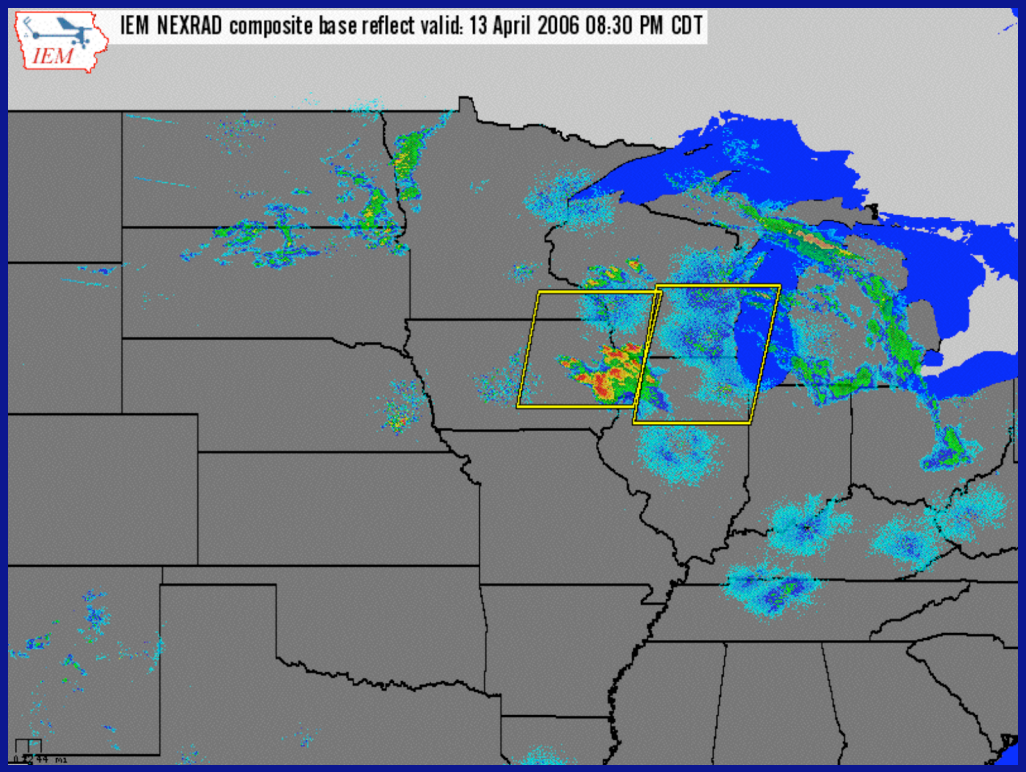
Data

- 26 March - 22 May 2006
- Mostly strongly forced cases (cold, warm fronts)
- 0-48 hour forecast

- NCEP Stage IV Observations

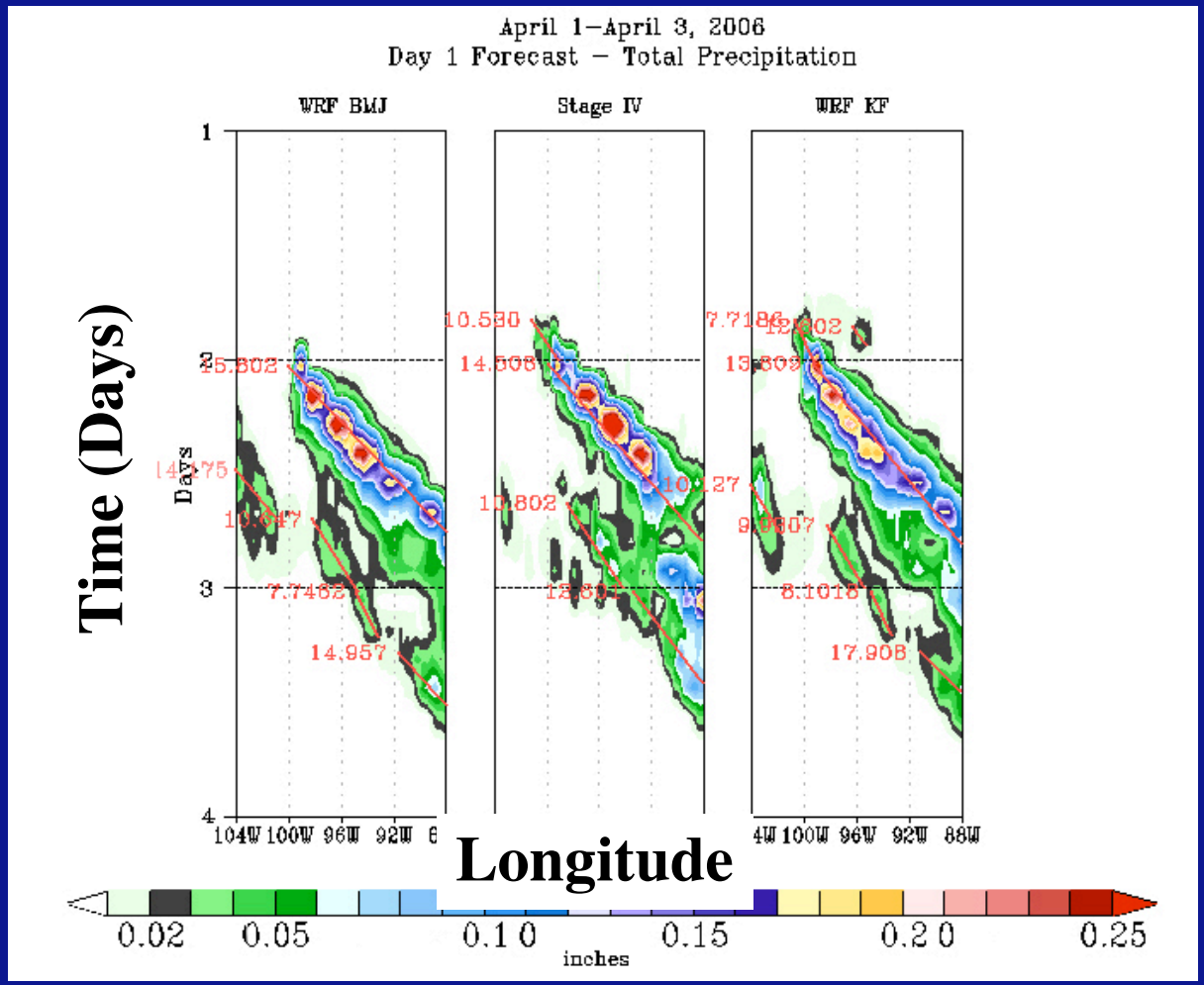
Methodology

- **Precipitation was only analyzed on days when it was determined to be…**
  - **Convective (>35dBZ)**
  - **Propagating**



Hovmöller Diagrams

- **Condense 3-D down to 2-D (Time-Longitude)**



Methodology

- 32 events were classified as “hits”
- 27 events were classified as “misses”

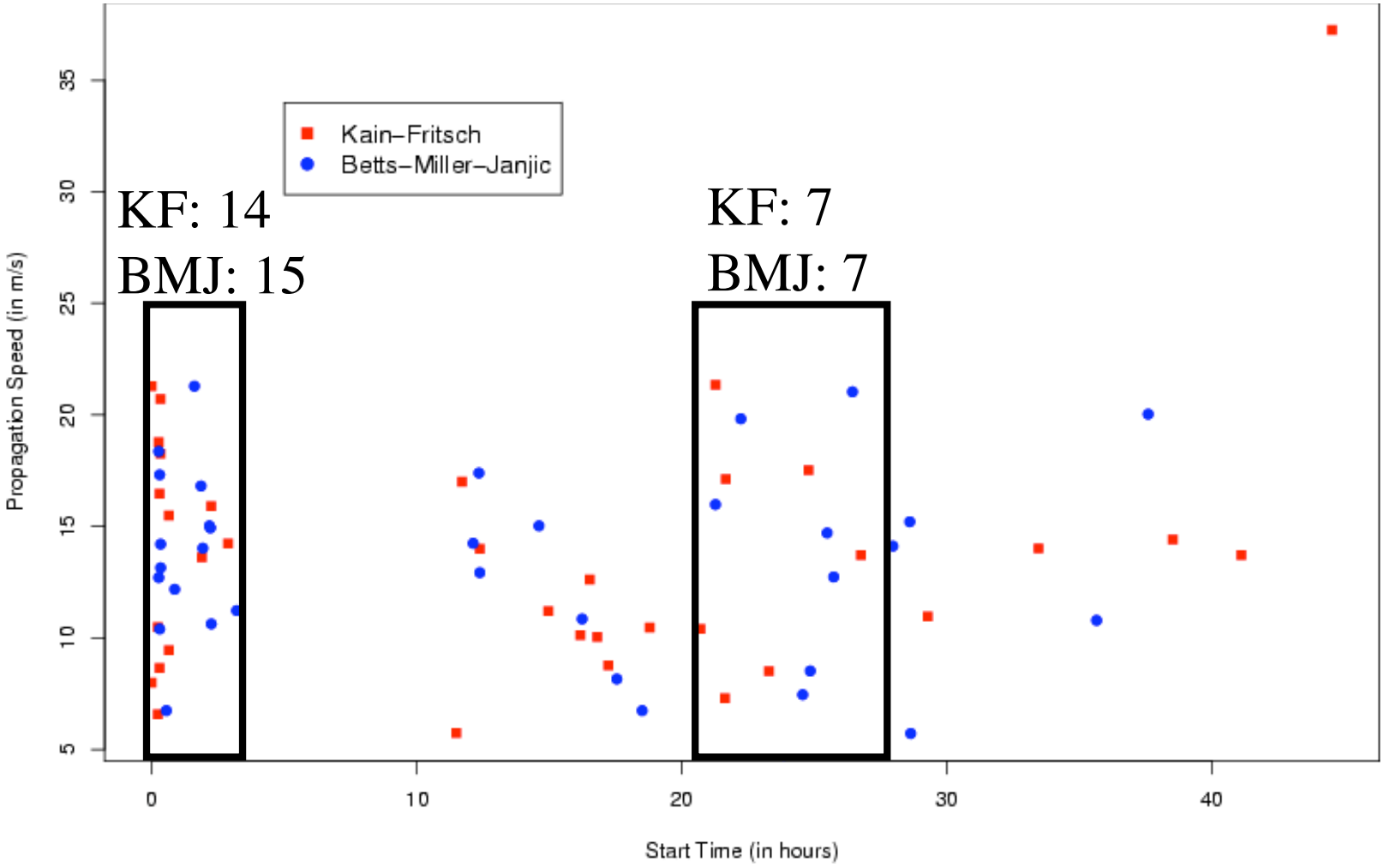
- What is a “hit” and a “miss”?
  - Hit is when both convective schemes and observations have the same event
  - Miss is when a convective scheme and/or observations misses the event

Statistical Analysis

- Propagation Speed
- Beginning Longitude
- Ending Longitude
- Start Time
- End Time

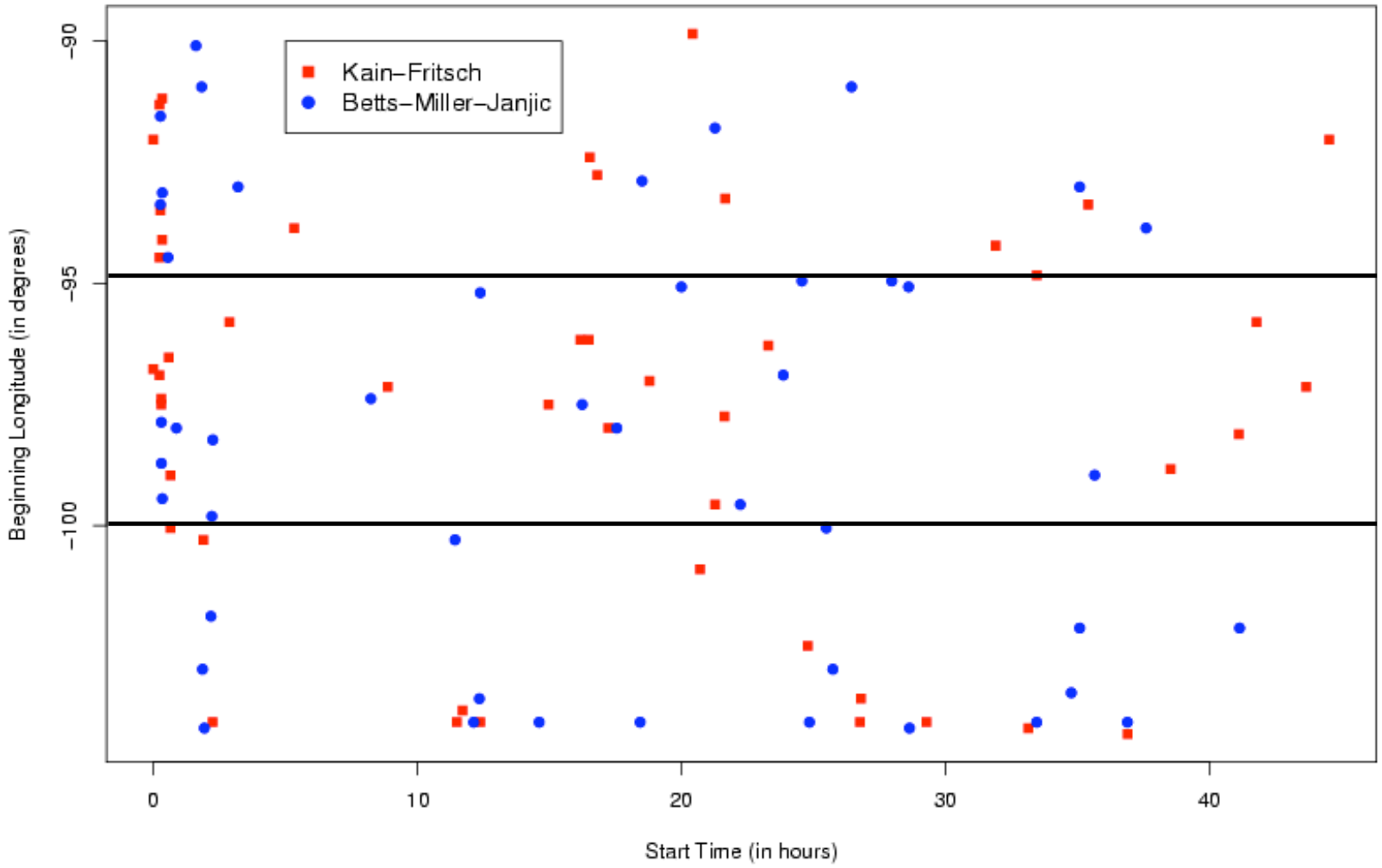
Results

Propagation Speed vs. Start Time



Results

Beginning Longitude vs. Start Time



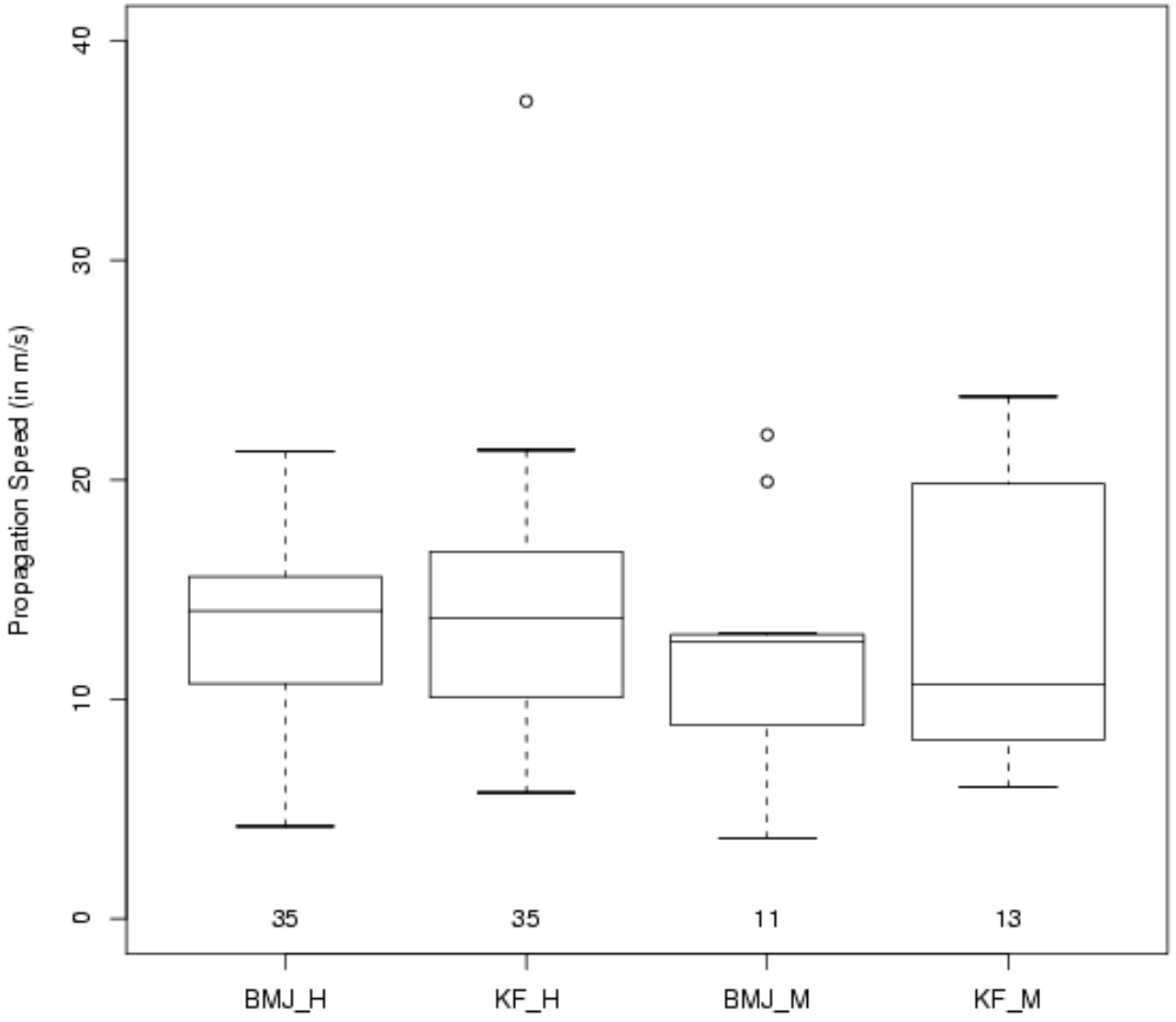
KF: 14
BMJ: 12

KF: 21
BMJ: 17

KF: 13
BMJ: 16

Results

Propagation Speed



Conclusions

Data Assimilation

- Central domain has events near start time
  - ~3.2 hours is the latest
  - Most of these are hits

Boundary Condition Effects

- KF captures 70% of events
- BMJ captures 60% of events
  - Boundary conditions are performing well

Conclusions

Variables

- Duration and propagation speed
  - Not as much separation between hits and misses
  - No definitive helpful forecasting tool

Caveats

- Time resolution
- Small sample size

Acknowledgements-Questions/Comments

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Undergraduate Symposium PowerPoint:

http://www.meteor.iastate.edu/~ajsorge/thesis