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

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# Overview

- Previous Work
- Motivation
- Data and Methodology
- Results
- Conclusions

# Previous Work

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

# Previous Work

- 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?**

# Hypothesis

- **The Betts-Miller-Janjic (BMJ) convective scheme will perform better than the Kain-Fritsch (KF) convective scheme when compared to observations in…**
  - **Beginning longitude**
  - **Propagation speed**

# Data

- Weather Research and Forecasting (WRF) with the Advanced Research WRF (ARW) dynamic core (Version 2.1.1)
- Initialized at 0000Z with Global Forecast System (GFS) model
- Mellor-Yamada-Janjic planetary boundary layer parameterization
- Ferrier cloud microphysics
- 15km grid-spacing over a domain from 104º to 88ºW and 35º to 50ºN

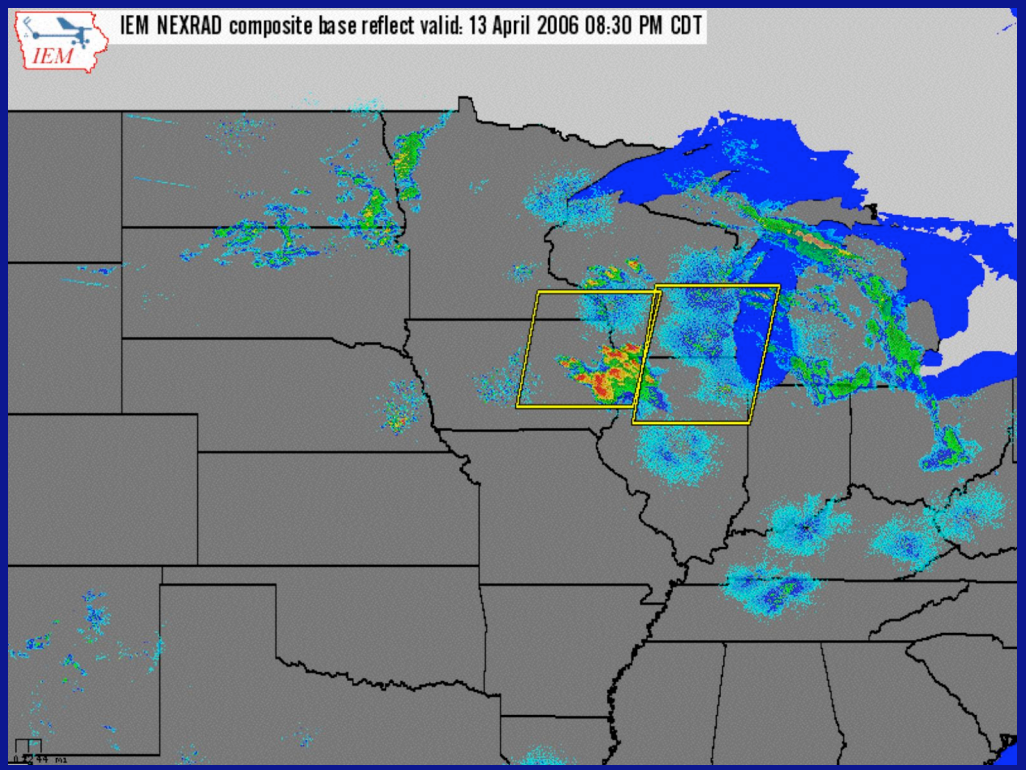
# Data

- 26 March - 22 May 2006
- Mostly strongly forced cases

- NCEP Stage IV Observations
- Forecast length was 120 hours w/3-h accumulated precipitation
- Day 1 and Day 2 forecast

# Methodology

- **Precipitation was only analyzed when…**
  - **Convective**
  - **Propagating**



# Methodology

- **Precipitation was only analyzed when…**
  - **In the model and the observations**

**Day 1 Forecast**

| Total Precipitation | Observed | Not Observed |
|---|---|---|
| Forecast | 32/34 | 5/7 |
| Not Forecast | 22/20 | 21/20 |

# Methodology

- **Precipitation was only analyzed when…**
  - **In the model and the observations**

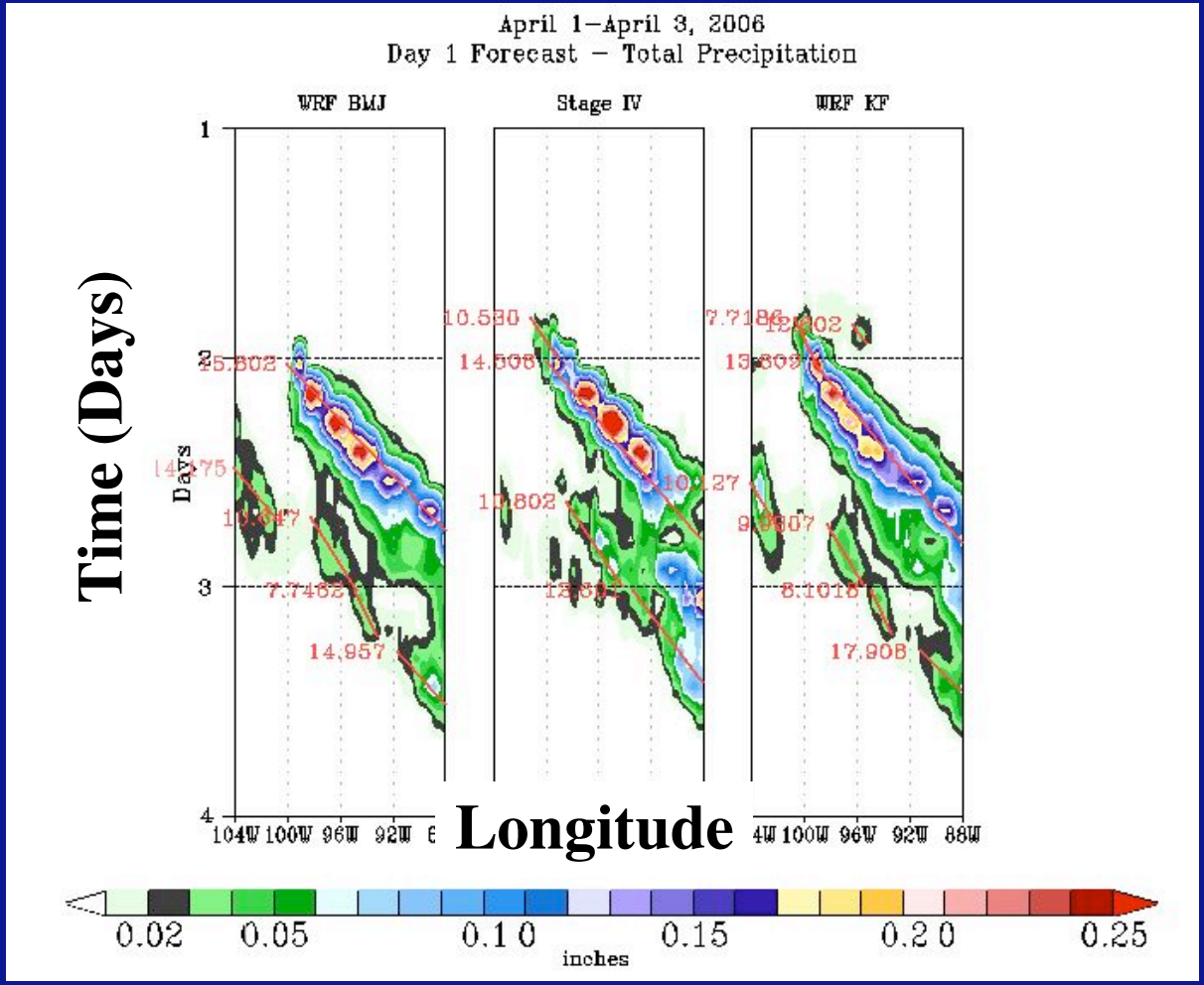
**Day 1 Forecast**

| Convective Precipitation | Observed | Not Observed |
|---|---|---|
| Forecast | 9/29 | 0/5 |
| Not Forecast | 42/24 | 25/21 |

# Methodology

- **Propagation Speed and Beginning Longitude**
  - **Time-longitude diagram or Hovmöller diagrams**

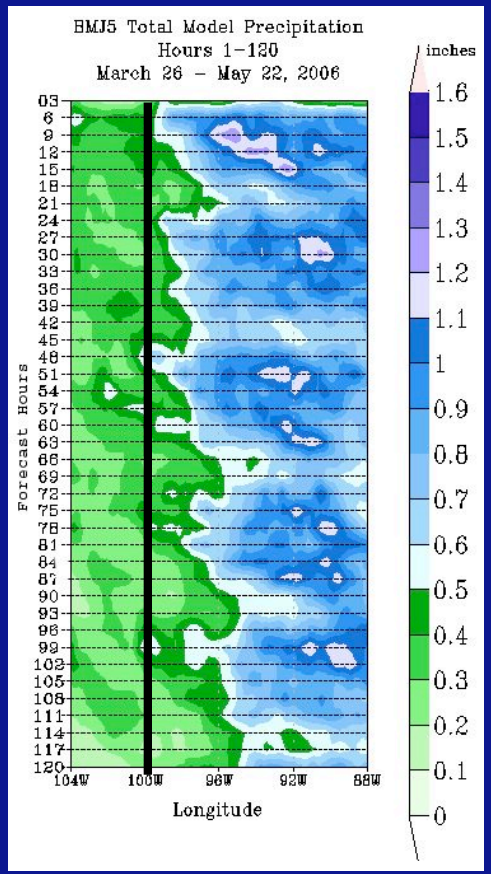
# Hovmöller Diagrams



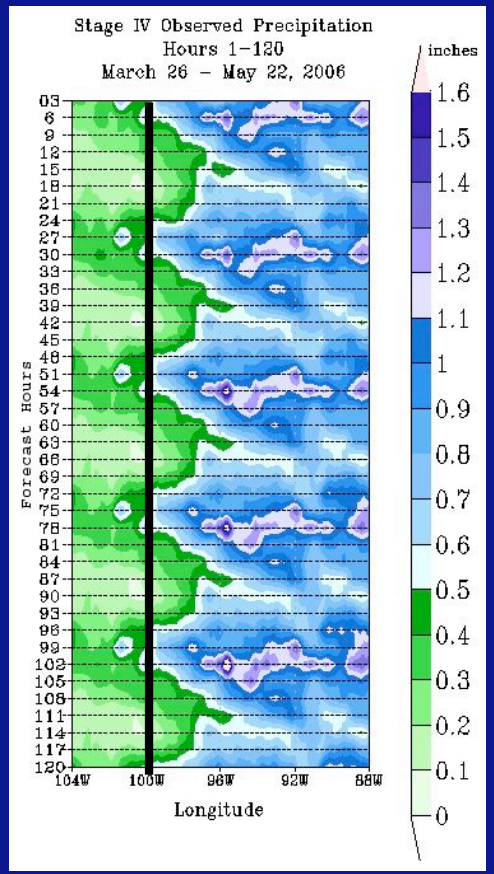
# Results - Diurnal Average

## Total Precipitation

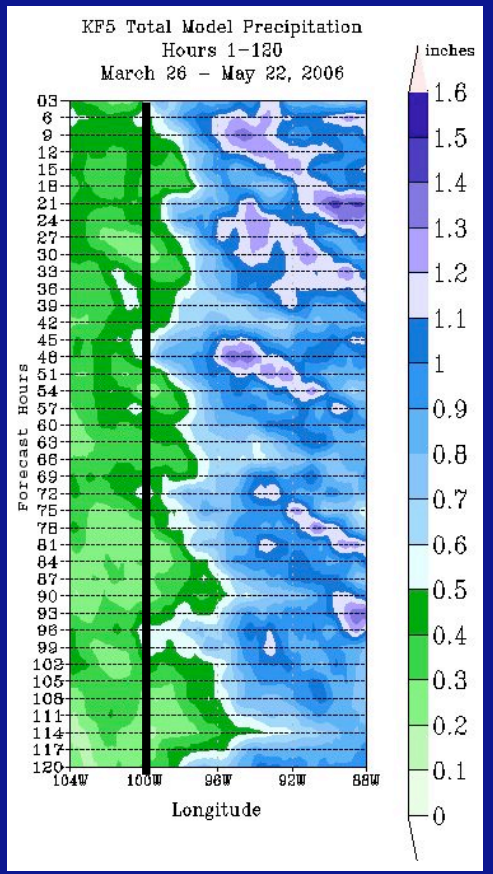
### BMJ




### Observations



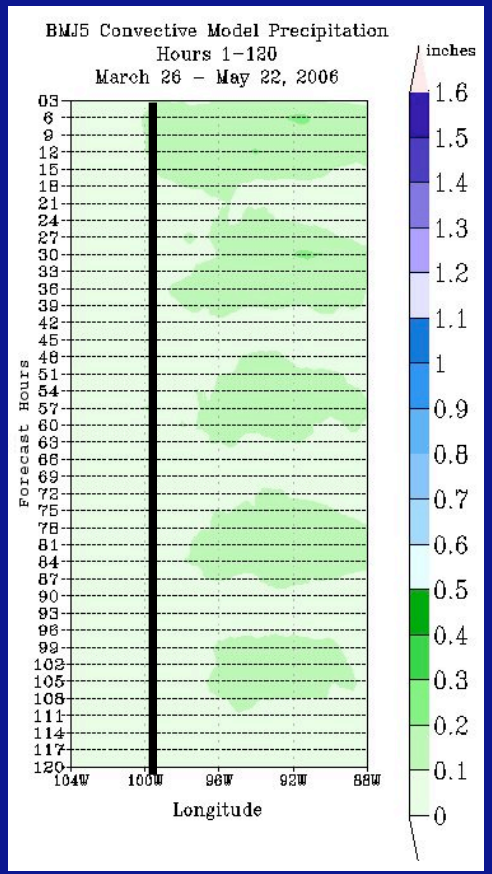

### KF



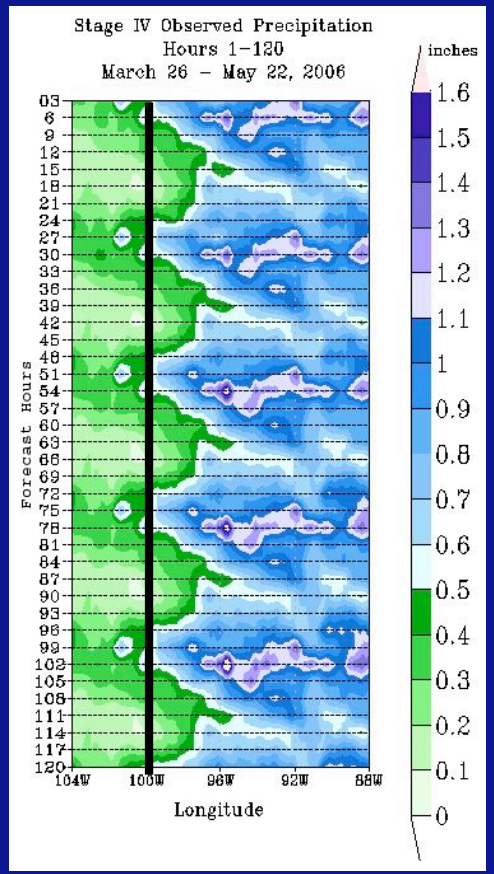
# Results - Diurnal Average

## Convective Precipitation

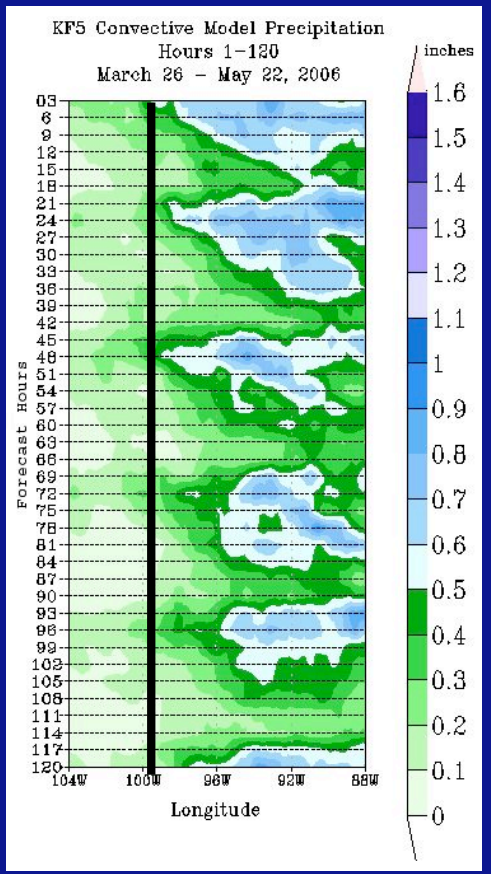
### BMJ




### Observations



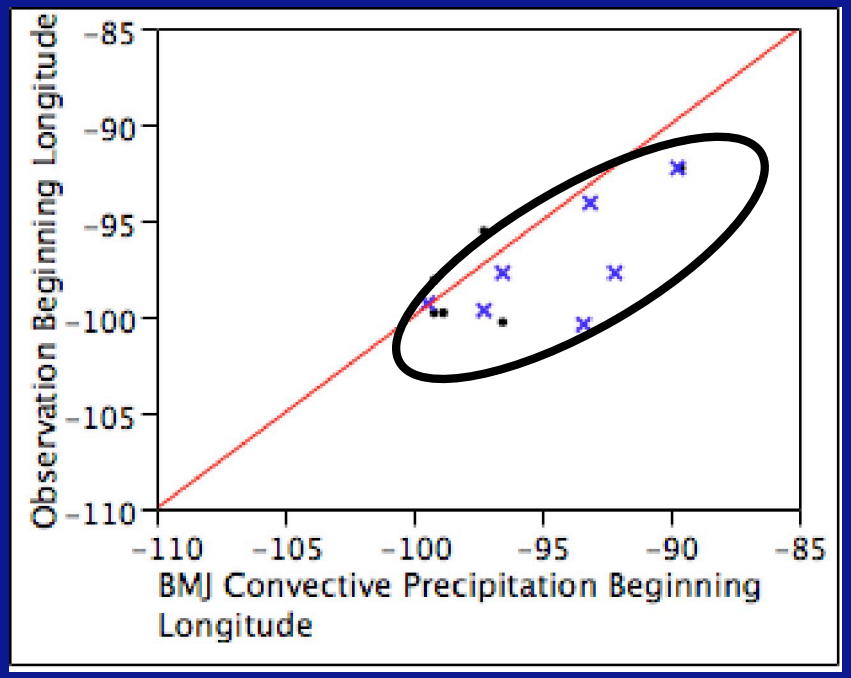

### KF

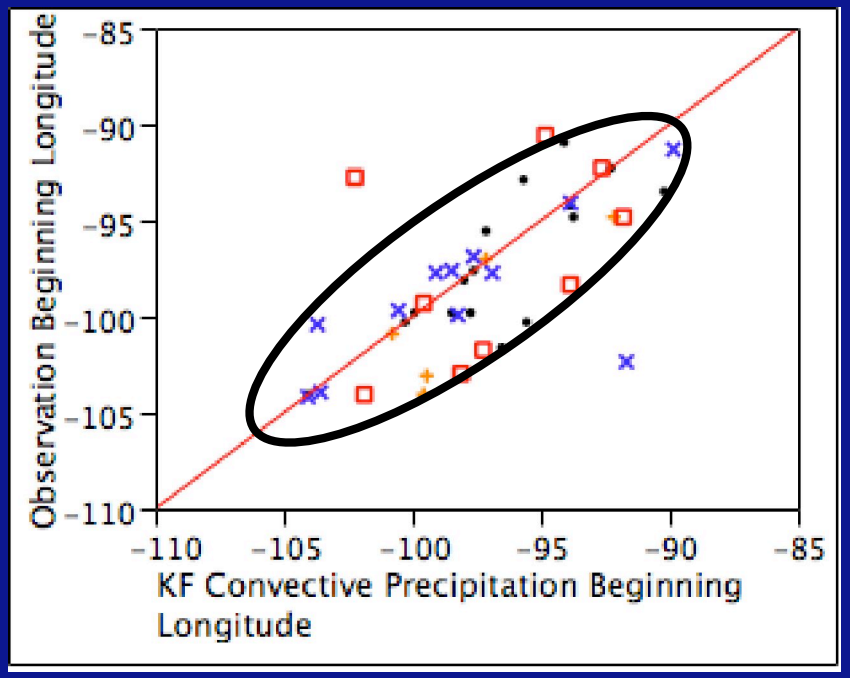


# Results - Convective Precipitation
## Beginning Longitude

**Key: Forecast Hour**

**0-12 - •  12-24 - +  24-36 - x  36-48 - □**



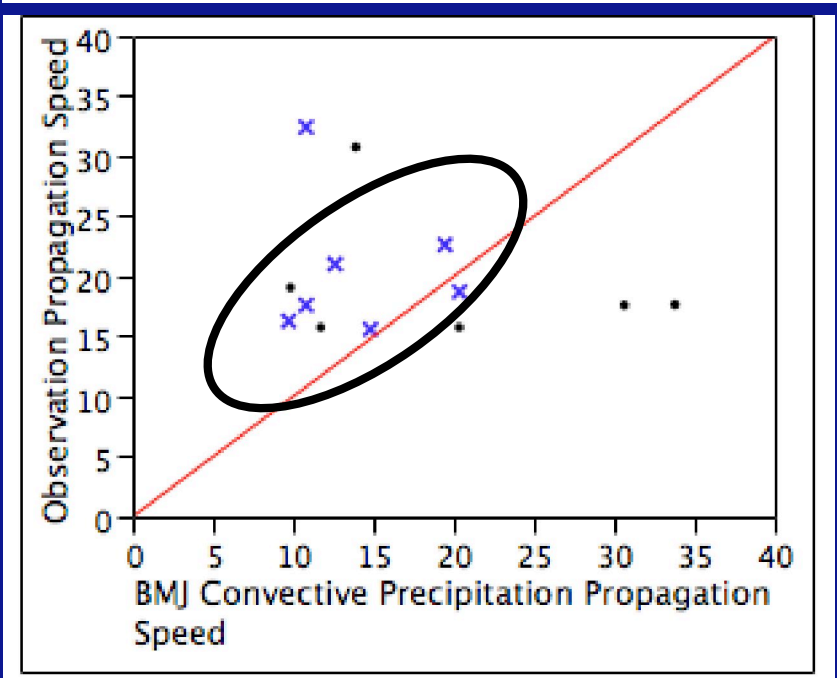

**BMJ vs. Observations**

**KF vs. Observations**

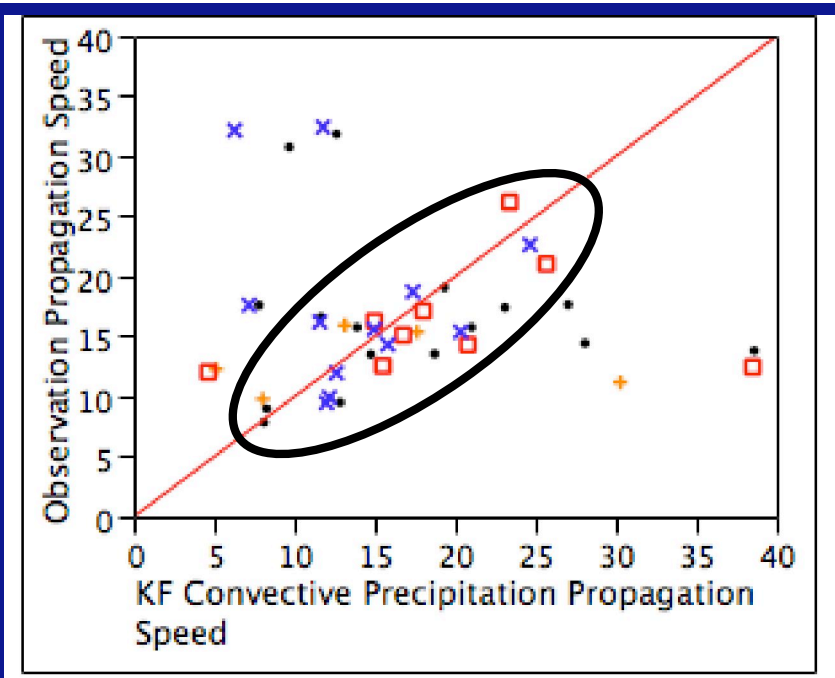
# Results - Convective Precipitation
## Propagation Speed (m/s)

**Key: Forecast Hour**

**0-12 - •  12-24 - +  24-36 - x  36-48 - □**




**BMJ vs. Observations**

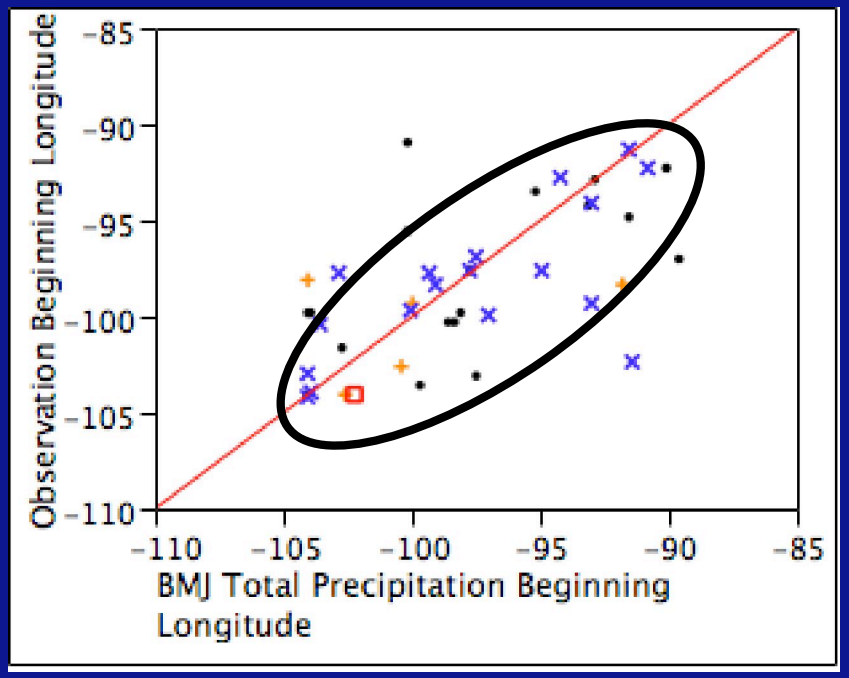



**KF vs. Observations**

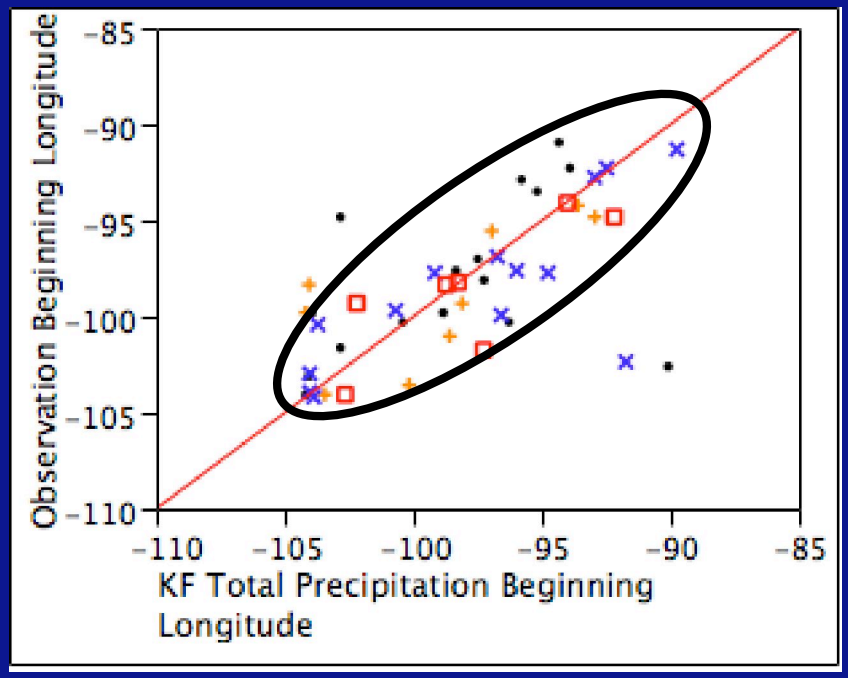
# Results - Total Precipitation
## Beginning Longitude

**Key: Forecast Hour**

**0-12 - •  12-24 - +  24-36 - x  36-48 - □**




**BMJ vs. Observations**

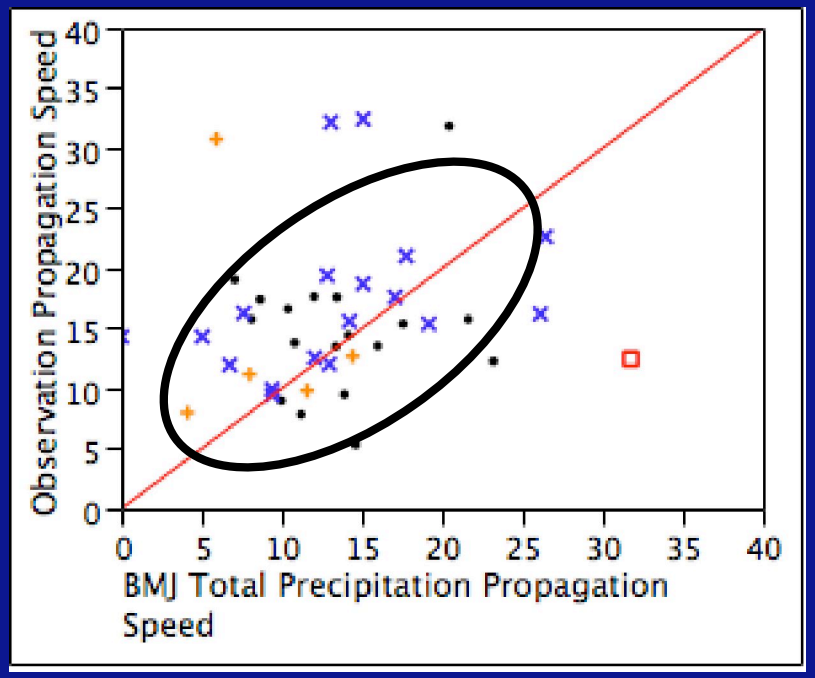



**KF vs. Observations**

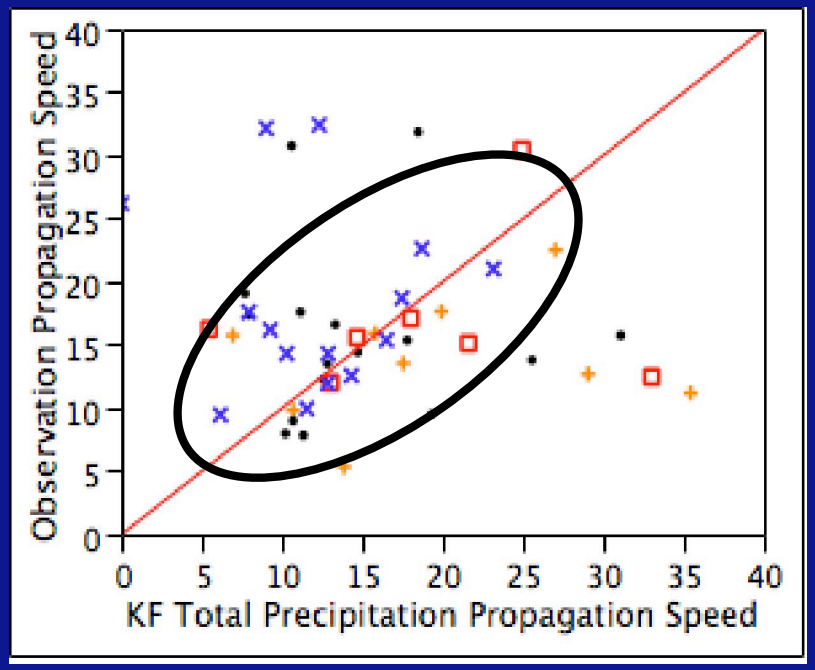
# Results - Total Precipitation
## Propagation Speed (m/s)

**Key: Forecast Hour**

**0-12 - •  12-24 - +  24-36 - x  36-48 - □**




**BMJ vs. Observations**




**KF vs. Observations**

# Conclusions

- **KF performed better than BMJ when compared to observations for both propagation speed and beginning longitude**

# Conclusions

- KF total precipitation beginning longitude
  - 0-12-h forecast placed precipitation further west of observations
  - 24-36-h forecast placed precipitation further east of observation
- More precipitation events in KF than BMJ
- KF propagation speeds were closer to observations than the BMJ

# Conclusions

- **BMJ non-convective precipitation does all the work--convective scheme doesn't produce enough precipitation**
- **BMJ propagation speeds were slower compared to observations**

# Future Work

- Directly compare events that are in the BMJ, KF, and observations
  - Will require a larger dataset
- Look at each individual event in the KF total precipitation 0-12 and 24-36-h forecast
  - Why was 0-12-h forecast further west in longitude when compared to observations?

# Future Work

- **Ending longitude**
  - **Does BMJ and/or KF end propagation accurately compared to observations?**
- **Are precipitation amounts accurately depicted in either BMJ or KF?**

# Acknowledgements

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# Questions or Comments

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**Written Thesis Paper and Undergraduate Symposium PowerPoint:**

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