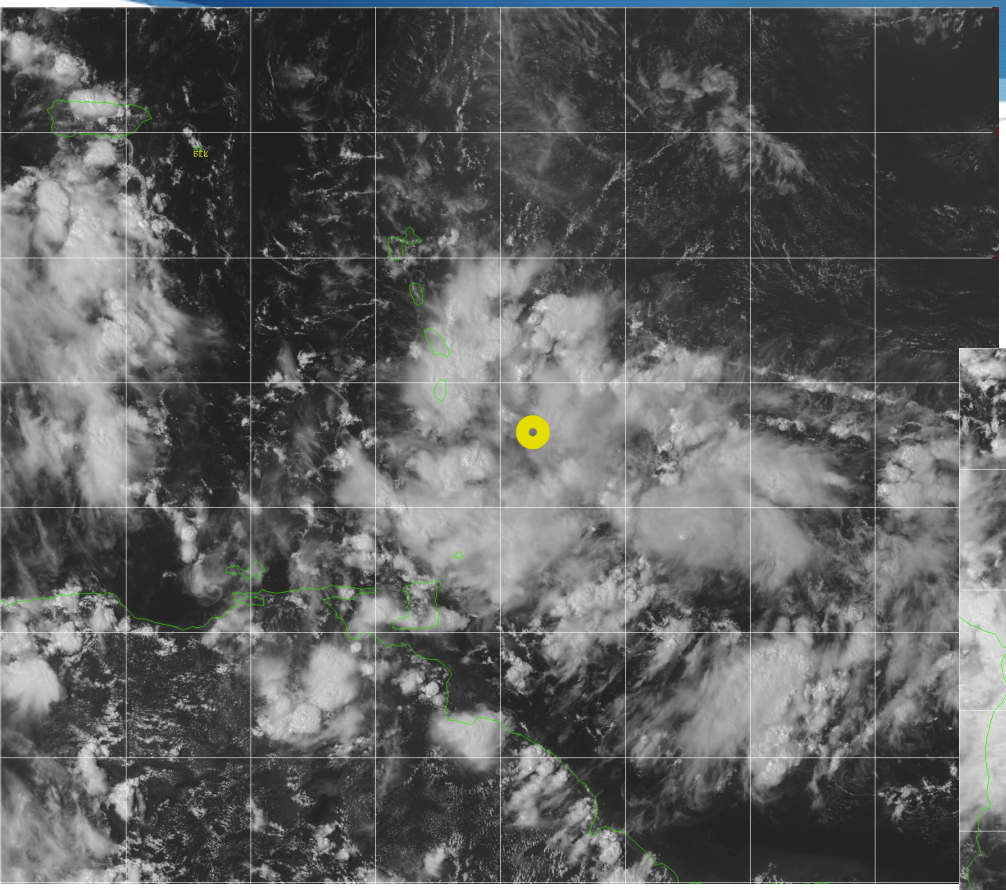
Assimilation of Conventional and Field Experiment Observations for Tropical Storm Mathew during GRIP/PREDICT 2010.

By

Ashford D'Arcy Reyes

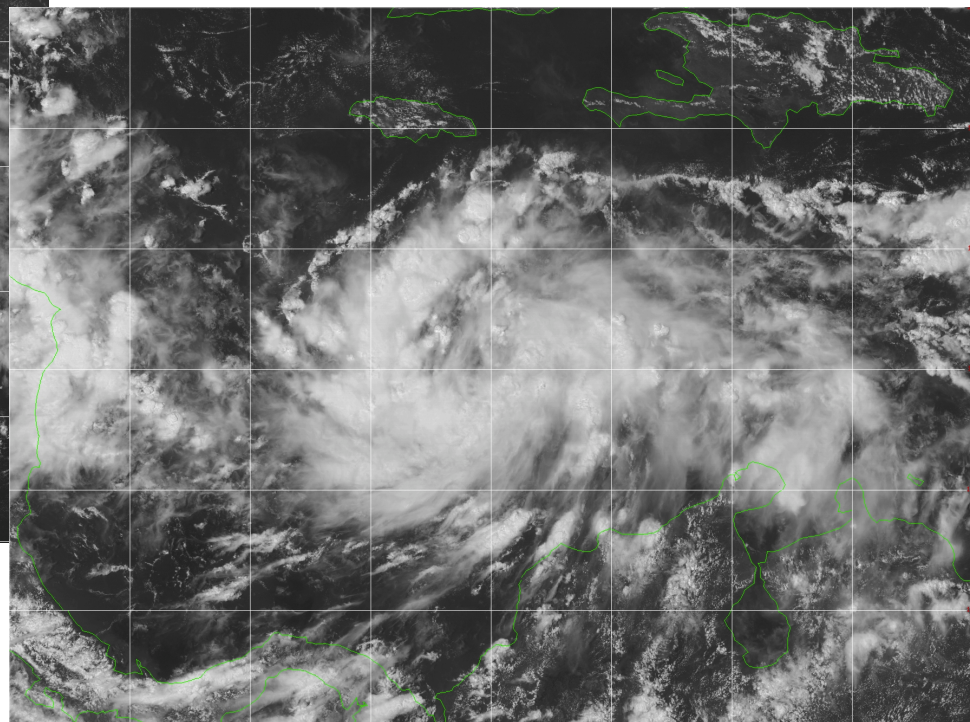
PhD Candidate, Howard University Program in Atmospheric Sciences (HUPAS)
Fellow, NASA Earth and Space Science

Tropical Storm Mathew



Pre-Mathew VIS Sept 20th @ 1815Z

Mathew VIS Sept 23rd @ 1815Z



Experimental Design

- E4DVar which uses WRF version 3.5.1 and PSU-EnKF.
- Initialized Sept 19th 00Z and cycled every 6-hrs.
- 60 ensemble members.
- Localization - 900 km & 15 vertical levels.
- Relaxation coefficient – 0.8

Model Setup

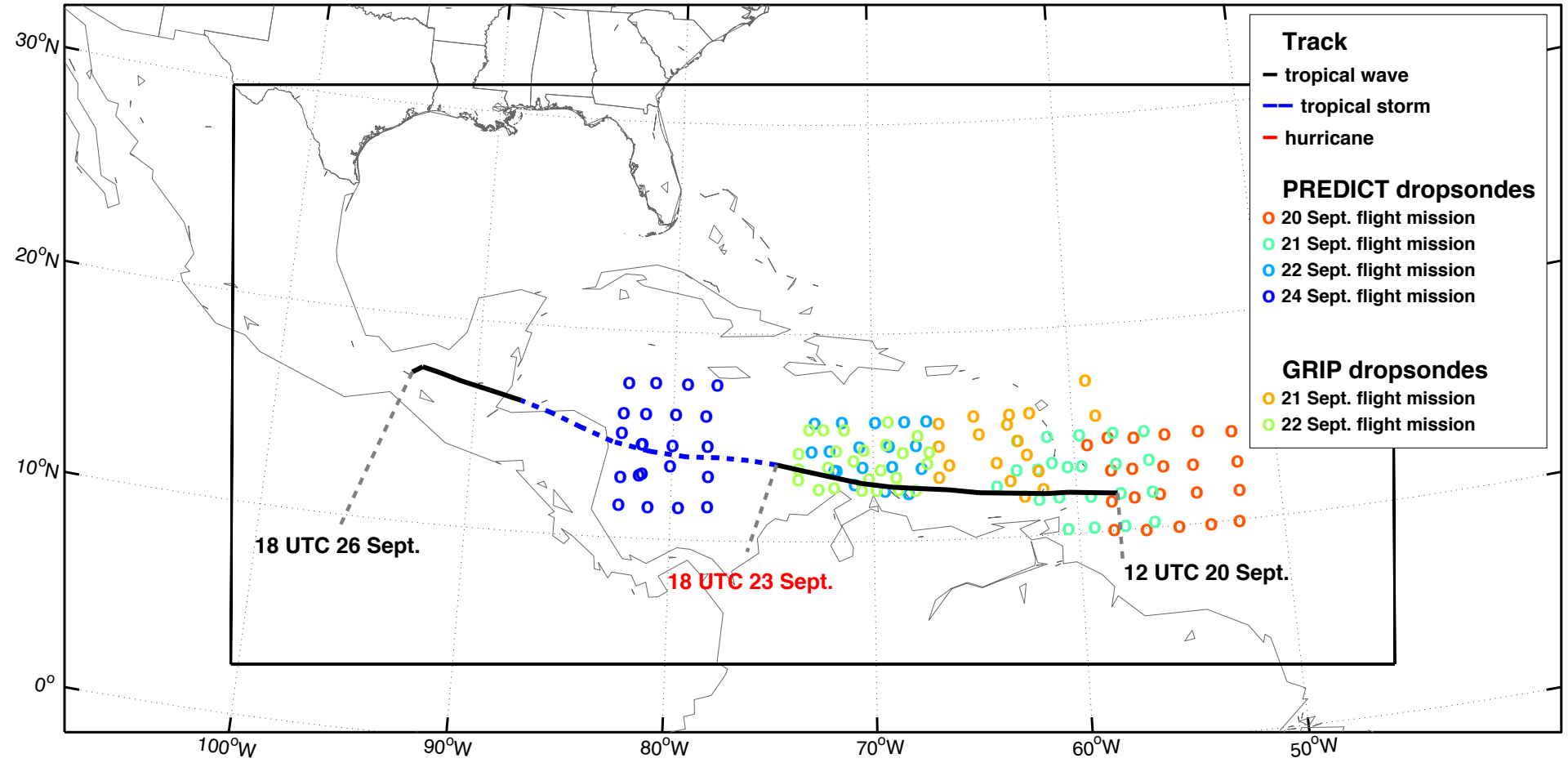
Domain	D01	D02	D03
Horizontal Grid (Km)	13.5	4.5	1.5
Grid Number	450 X 225	253 X 253	568 X 568
Time Step (mins)	45	15	5
Initial and Boundary Conditions	FNL	FNL	FNL
Microphysics	WSM6	WSM6	WSM6
Cumulus	None	None	None
Boundary Layer	MYJ	MYJ	MYJ
Longwave Radiation	RRTM	RRTM	RRTM
Shortwave Radiation	Dudhia	Dudhia	Dudhia
PBL	YSU	YSU	YSU

Field Experiment Observations

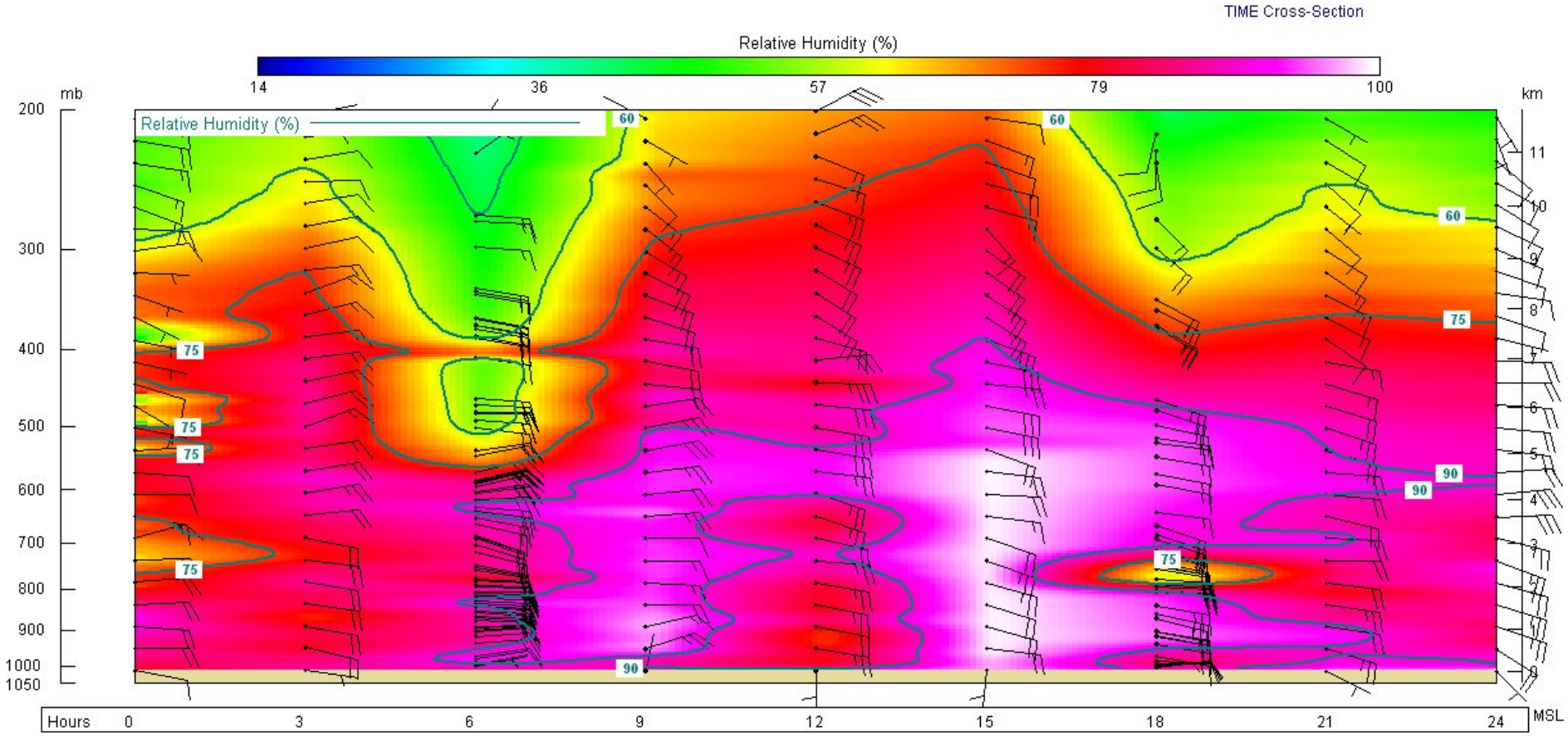
	GRIP			PREDICT
	Pre-Genesis	**After Genesis**	**Total**	**Pre-Genesis**
Mathew	44	0	44	61

Date	Launch Times	Associated System
September 20th	00Z, 06Z, 12Z, 18Z & 21Z	Pre-Mathew Disturbance
September 21st	00Z, 03Z, 06Z, 09Z, 12Z, 15Z, 18Z & 21Z	Pre-Mathew Disturbance
September 22nd	00Z, 03Z, 06Z, 12Z & 18Z	Pre-Mathew Disturbance

Life Cycle Mathew

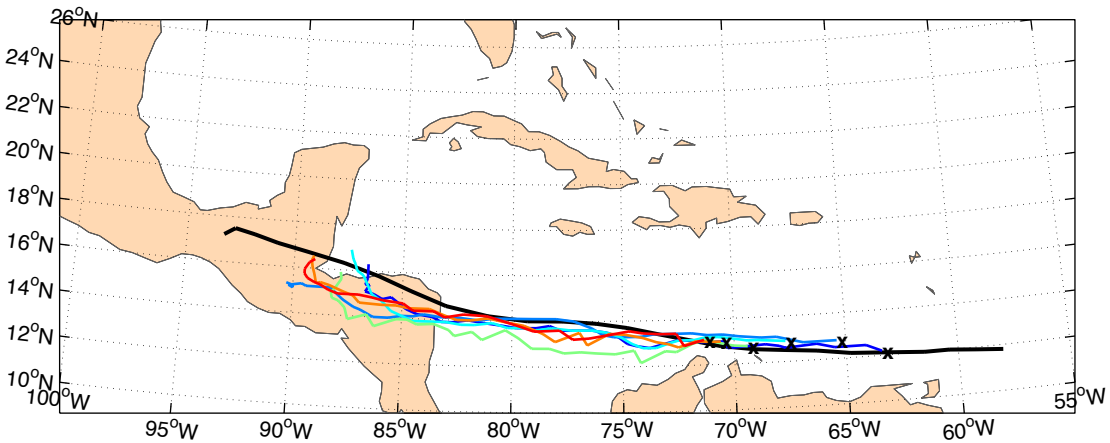


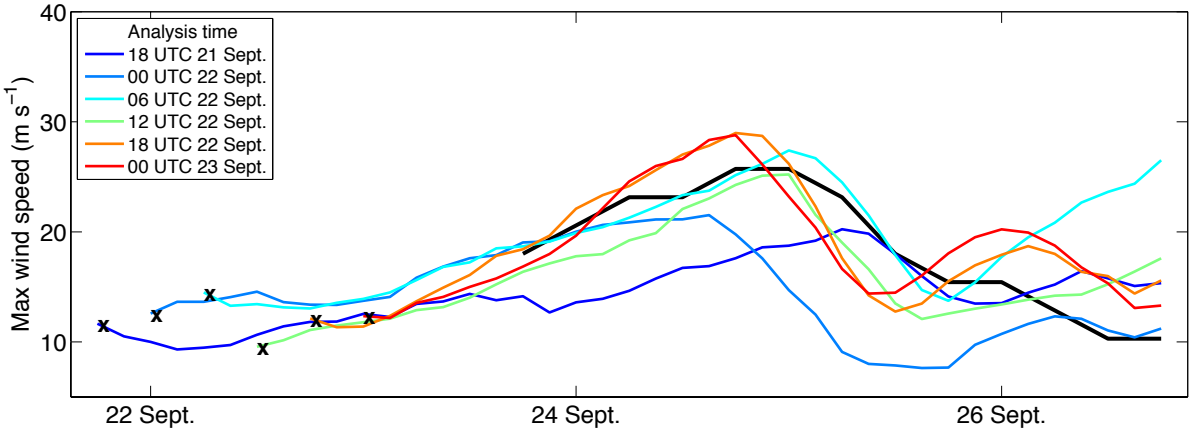
Barbados Soundings



PRELIMINARY RESULTS

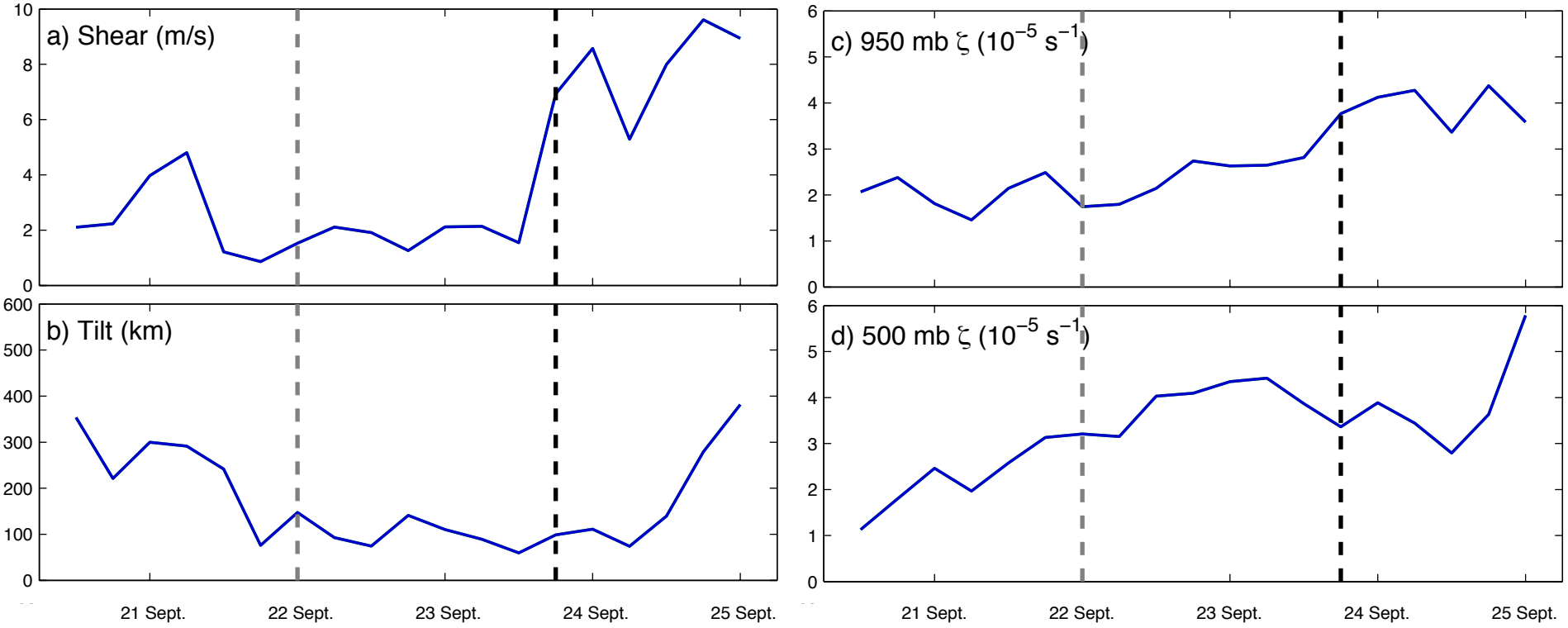
Track and Intensity Forecast



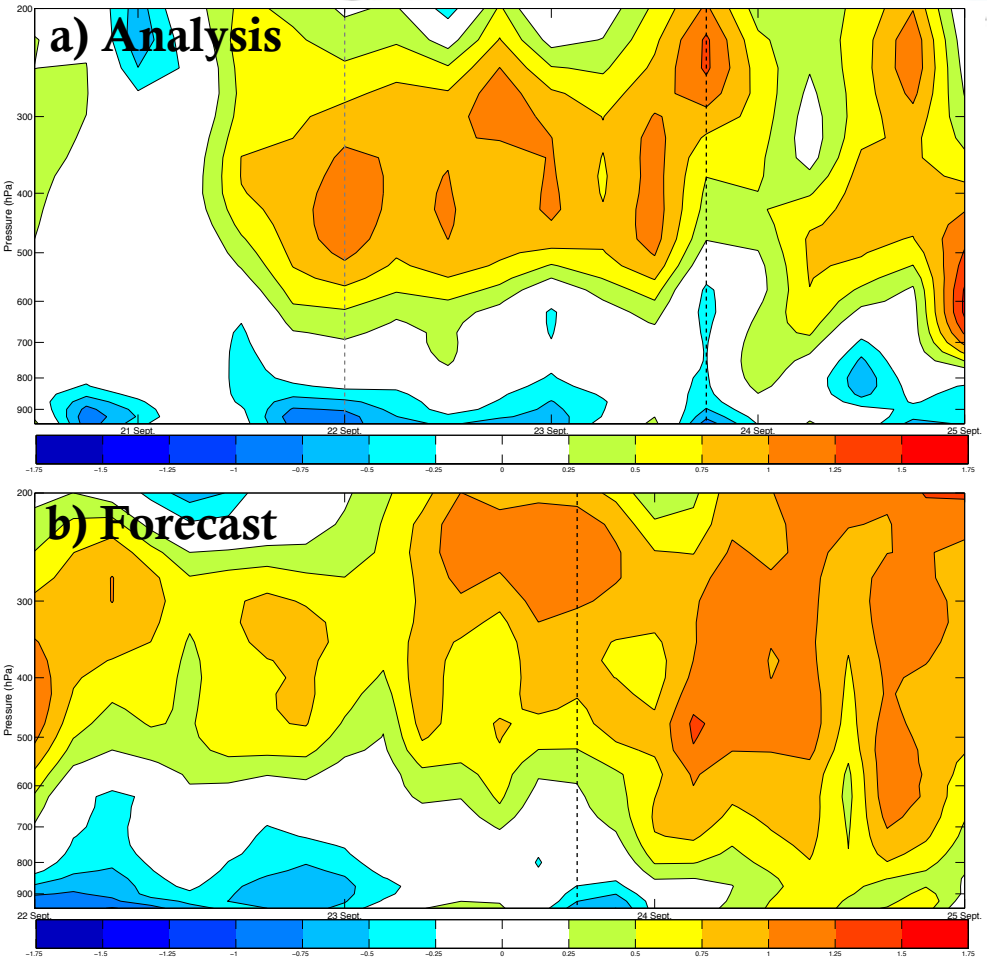


- E4DVar was able to simulate Mathew's track relatively well.
- Mathew's genesis was predicted 42-hrs in advanced.
- The forecast was consistent for 36-hrs.

Wind Shear, Tilt and Vorticity

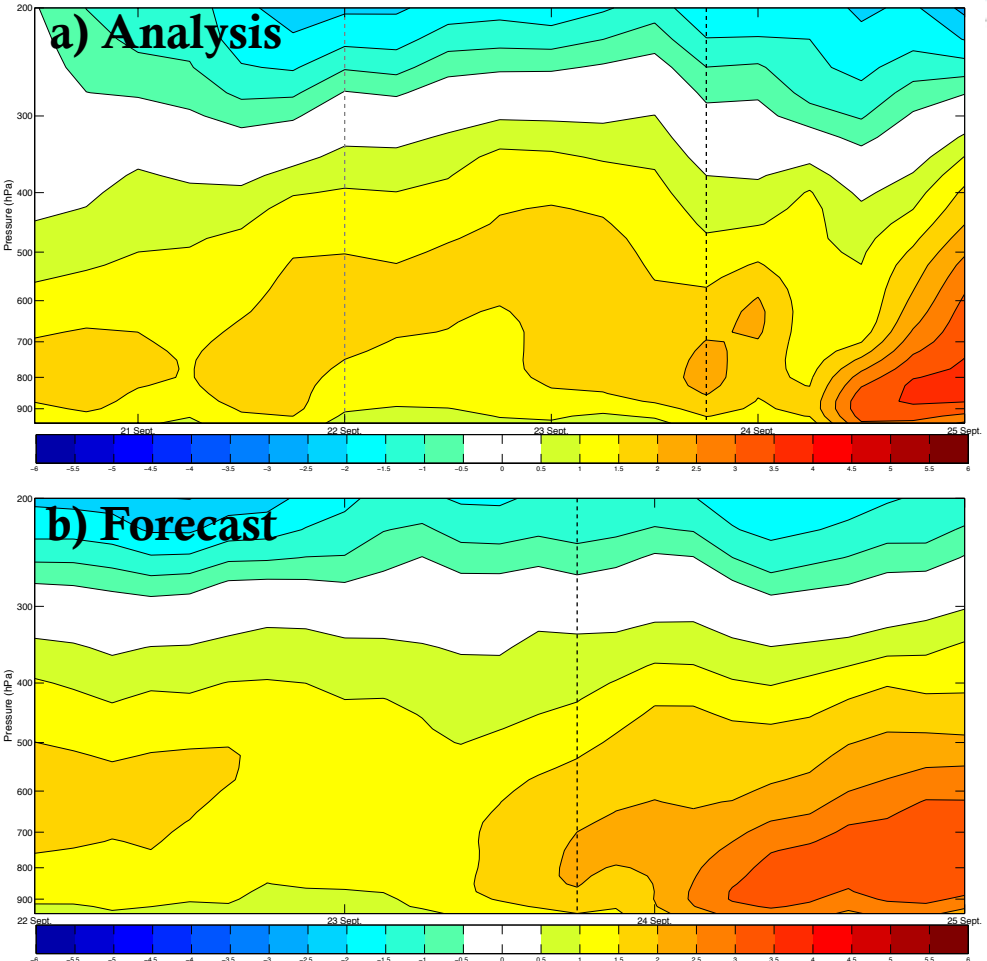


Perturbation of Virtual Potential Temperature Profiles



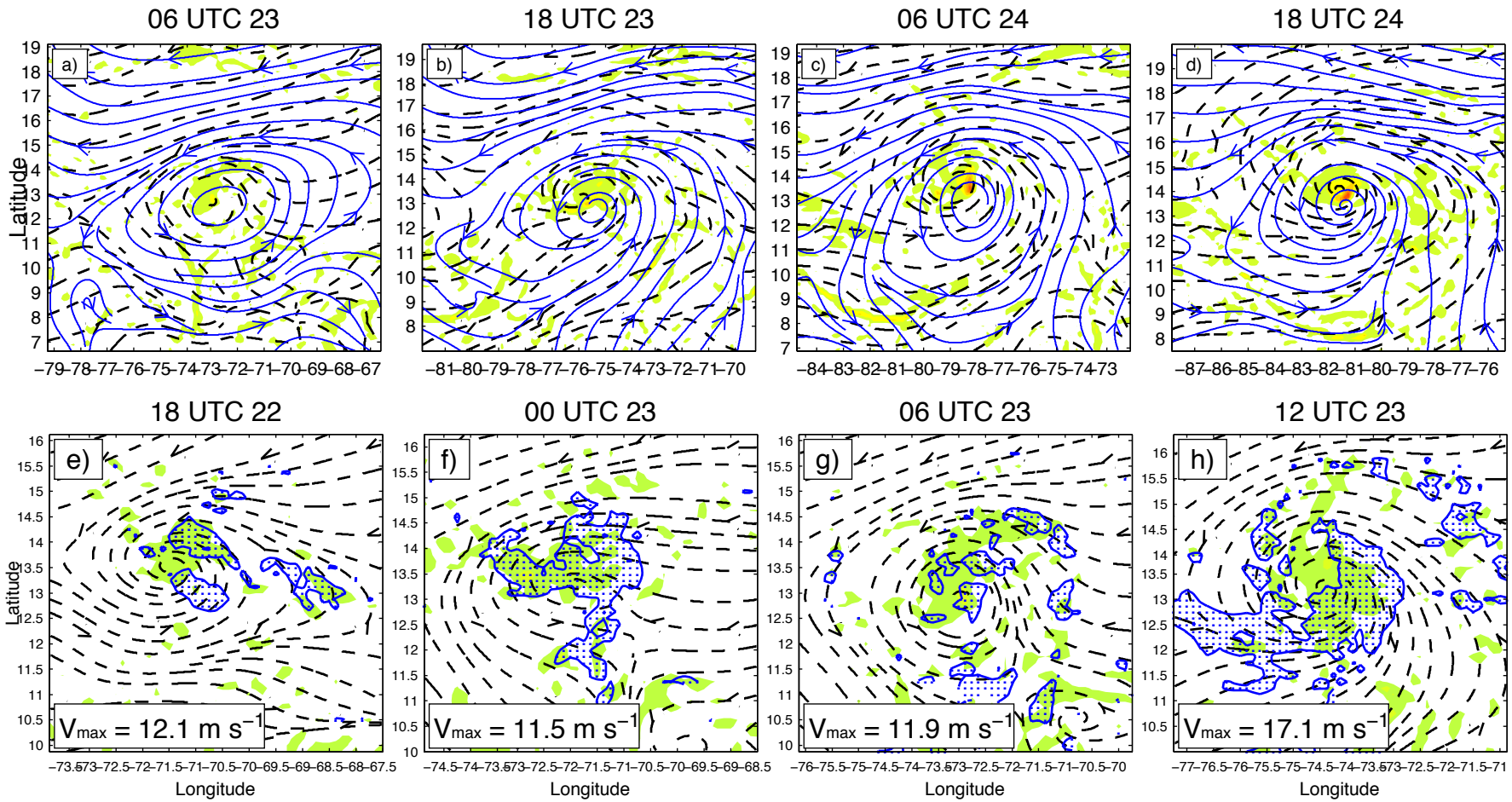
- Warming in the mid to upper levels prior to genesis.
- Cooling at the surface together at time of genesis.
- Sept. 22nd 00Z simulation was able to forecast cooling at the surface and warming in the upper levels at time of genesis.

Relative Vorticity Profile



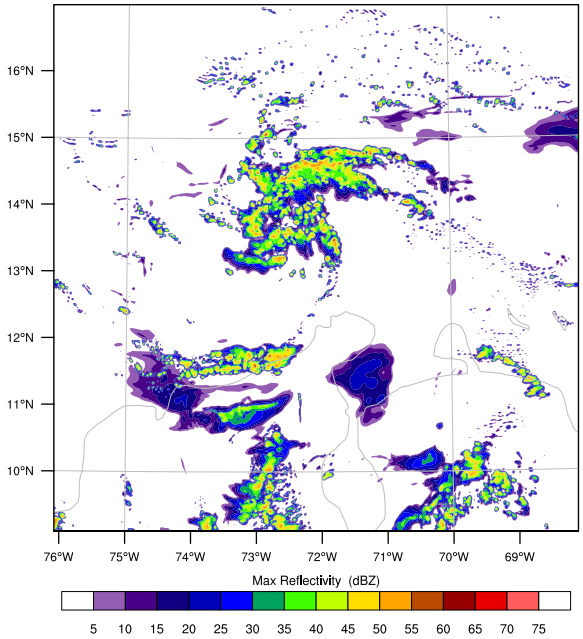
- Analysis shows an increase of the vorticity field between 800-700 mb at the time of genesis.
- Sept 22nd 00Z simulation shows similar trend in its forecast at the time of genesis.

Sept. 22nd 18Z Forecast

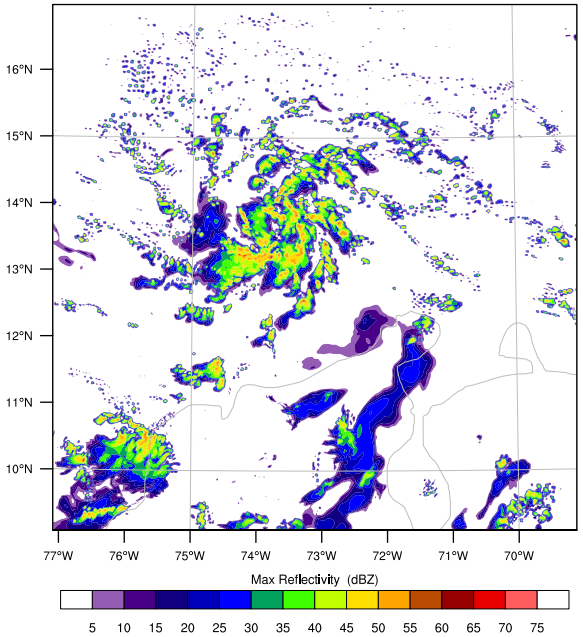


Max Reflectivity

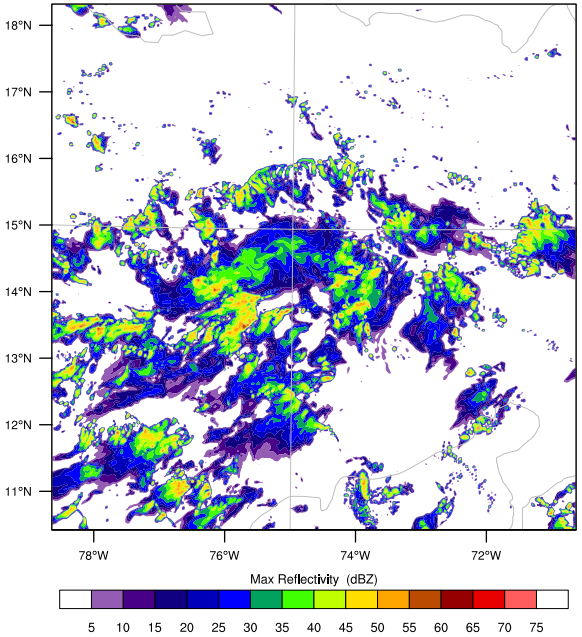
a) 06 UTC 23



b) 12 UTC 23



c) 18 UTC 23



Future Work

- Perform a quantitative verification of Mathew's E4DVar analysis.
- Perform analysis of the dynamics associated with the genesis of Mathew and conduct ensemble sensitivity runs.
- Add GRIP dropsondes and soundings to Jon existing Karl case and perform similar analysis to that of Mathew.

ACKNOWLEDGEMENTS

- Gregory Jenkins, Howard University.
- Fuqing Zhang, Penn State University.
- Jonathan Poterjoy, Penn State University.
- Christopher Melhauser, Penn State University.
- Yonghui Weng, Penn State University.

THANK YOU