

Evaluation of Potential Impacts of Doppler Lidar Wind Measurements on High-impact Weather Forecasting: A Regional OSSE Study

Zhaoxia Pu

Department of Meteorology

University of Utah

Salt Lake City, UT

Email: Zhaoxia.Pu@utah.edu

Acknowledgements:

Lei Zhang, *Univ. of Utah*

Bruce Gentry, *NASA GSFC*

Belay Demoz, *Howard University*

Michiko Masutani, *EMC/NCEP, Joint OSSEs*

Ramesh Kakar, *NASA/HQ*

Robert Atlas, *NOAA/AMOL*

Las Peter Riishojgaard, *JCSDA*

Presentation for Joint OSSE meeting

January 30, 2009

About this talk

- **Evaluation of ECMWF NR for regional OSSEs**
- **Preliminary results of regional OSSEs with Doppler Wind Lidar (DWL) measurements**
- **Problems and challenges in regional OSSEs**

Previous OSSEs with Doppler Lidar Wind (DLW)

- **Liu and Kalnay (2007), adaptive targeting strategies (simple global model)**
- **R. Atlas et al. (2008), Impact of DLW on hurricane track forecast (NASA global model)**
- **M. Masutani (2008), Evaluation of the impact of DLW with NCEP GFS**
- **D. Emmitt (2008), Various experiments with DLW**

- **Most of previous OSSEs have been done with global models**
- **Impact of DLW data on high-impact weather system (e.g. hurricane) has been examined (Atlas et al. 2008; Emmitt et al. 2008).**
Positive impact has been shown on hurricane track forecasts.

Science Objective

To what extent can next generation DLW observing system improve the hurricane *intensity* forecast?

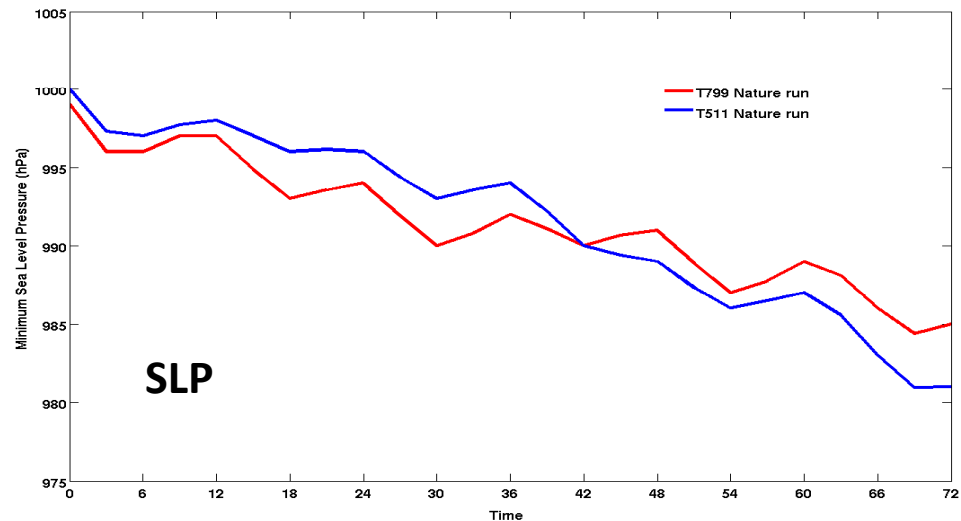
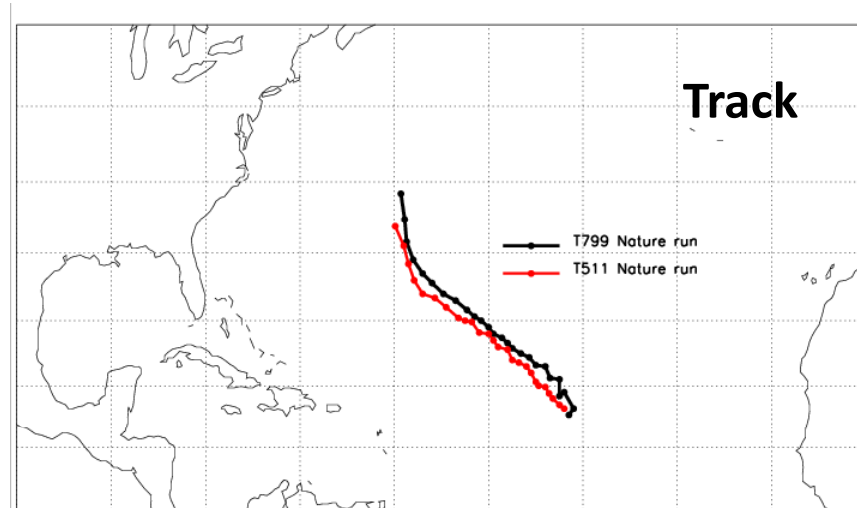
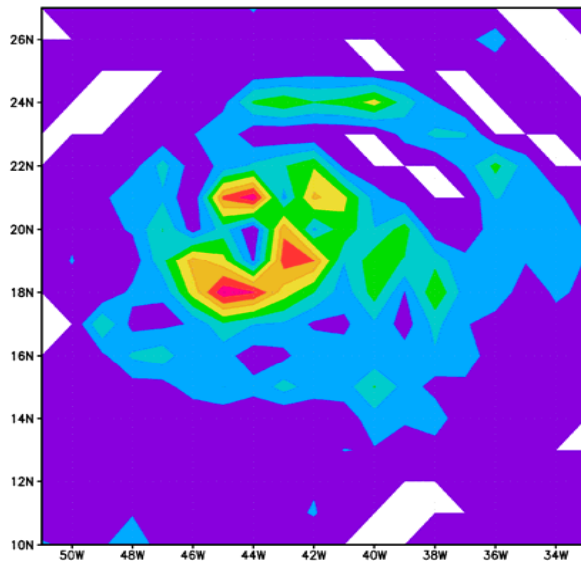
Do ECMWF global natural runs represent hurricane structure?

Case:

00UTC October 1 2005 –
00UTC October 4, 2005

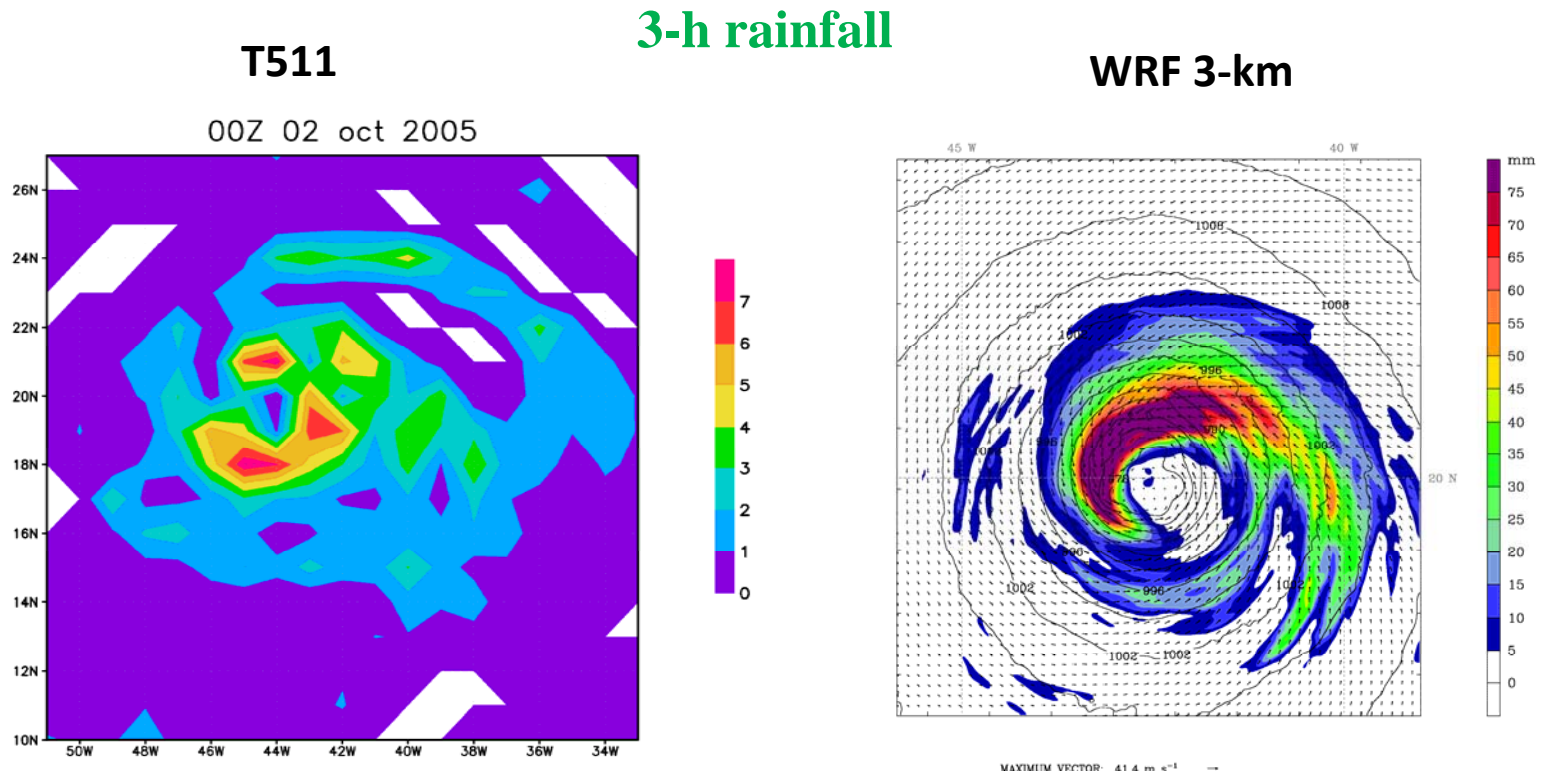
3-h rainfall (T511)

00Z 02 oct 2005



Tropical cyclones were found to be reasonably well represented in the Natural Run for a model of intermediate resolution.

Are ECMWF natural runs adequate for verification purposes?



Due to the relatively low resolution of the Natural Run in comparison with the scale of the storm inner core structure, the data may only be useful for the OSSEs that focus on tropical cyclone track forecasting rather than intensity forecasting.

Regional OSSEs

Regional Natural Run (RNR):

Regional numerical simulation with mesoscale community WRF model nested inside of EC T799 Natural Run

CTRL run:

WRF simulation nested inside of EC T511 Natural Run

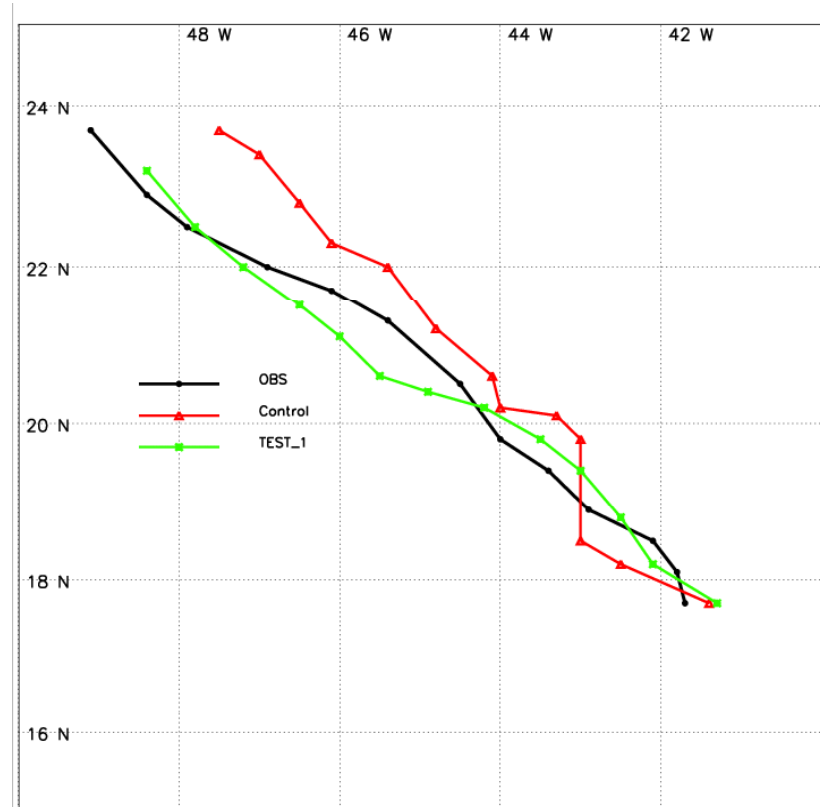
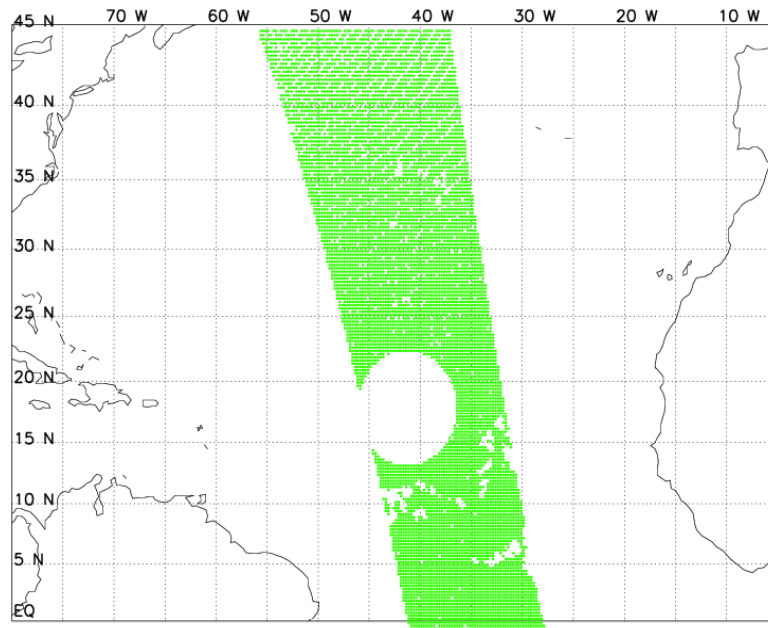
Physics options are different in RNR and CTRL.

Data Assimilation system : WRF 3DVAR

Verification

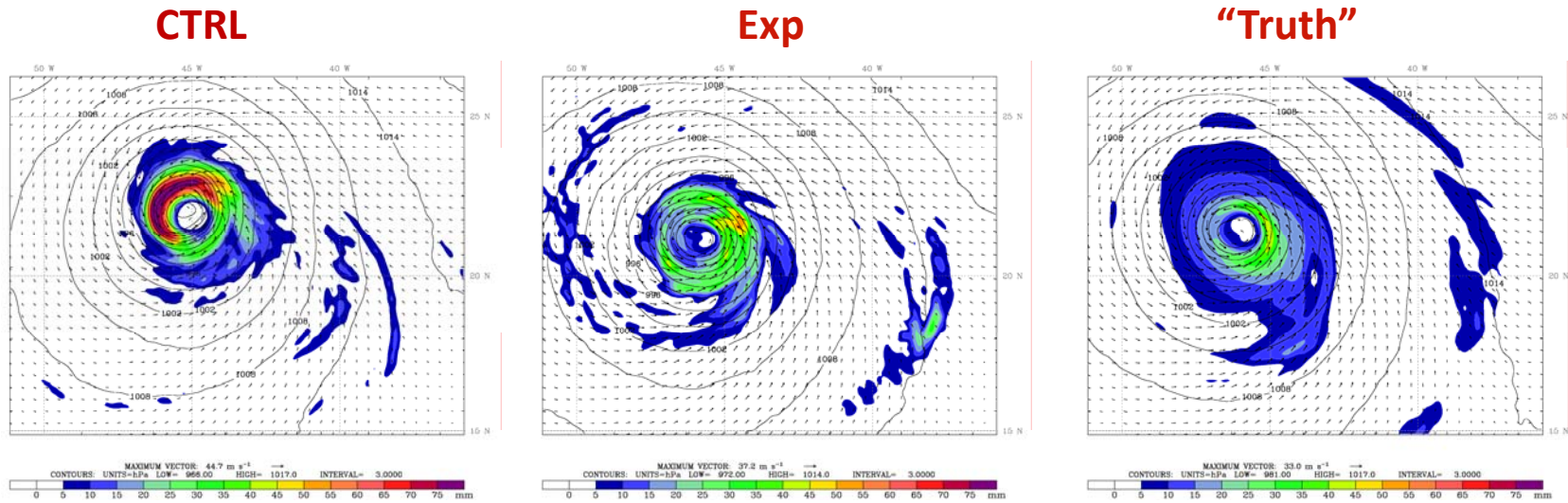
Regional OSSE results

Data Impact



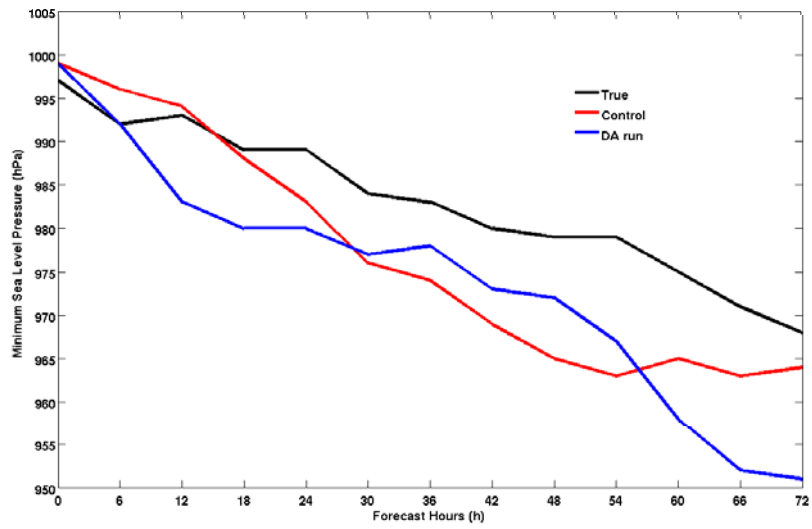
Regional OSSE results

3-h precipitation at 48 h fcst

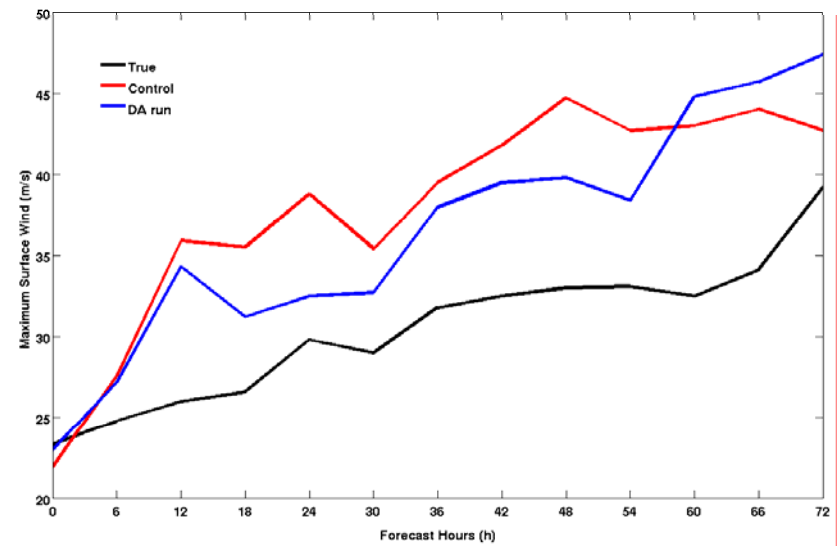


Regional OSSE results

Minimum central SLP

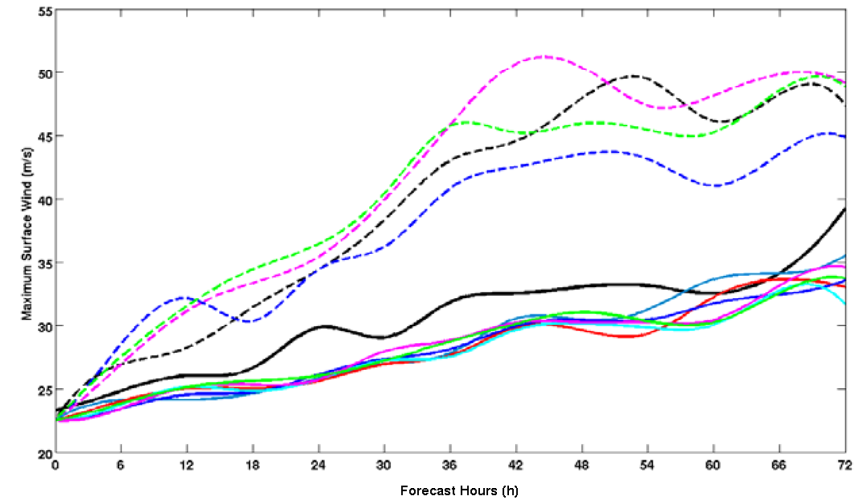
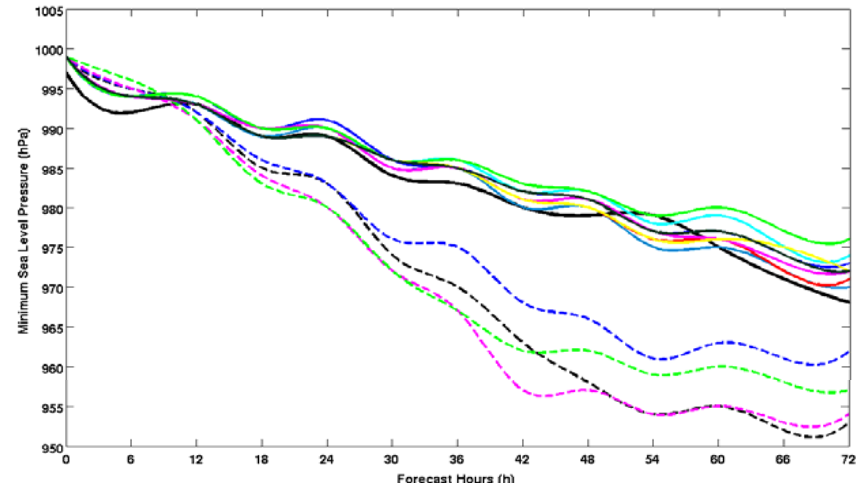
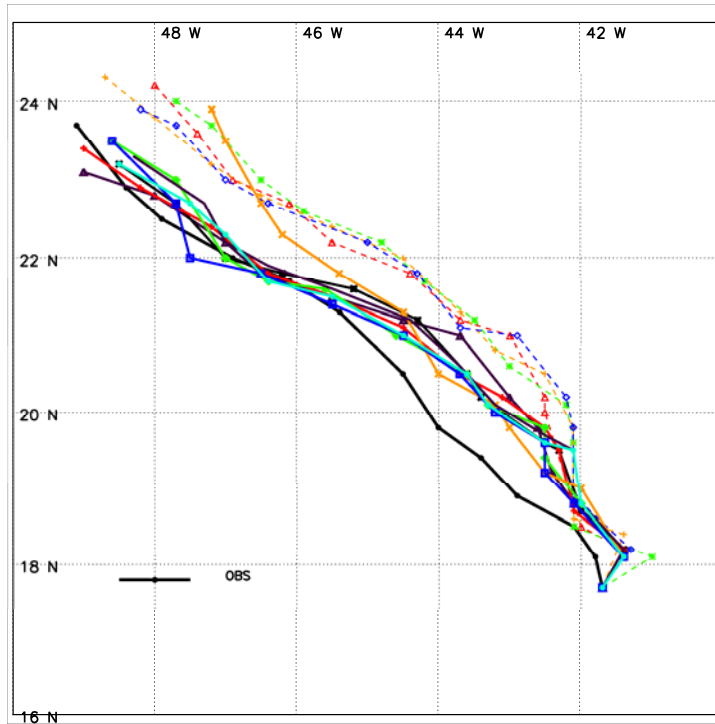


Maximum surface wind



Some issues with regional OSSEs

Forecast is very sensitive to physics parameterization options



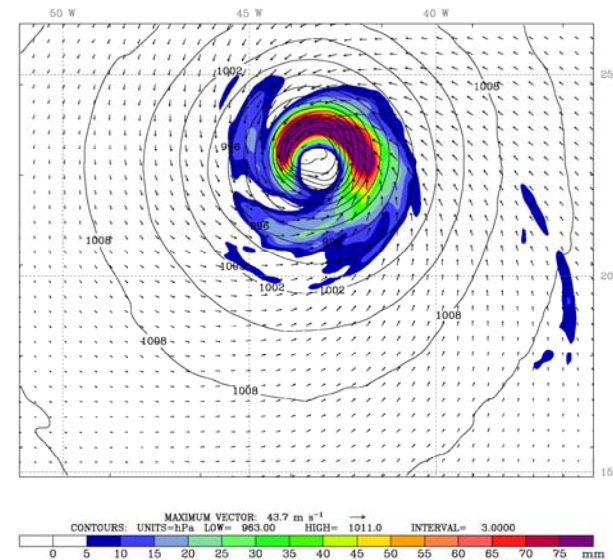
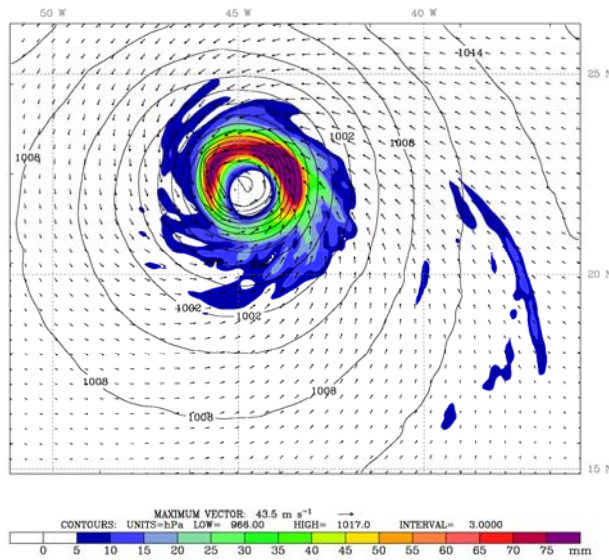
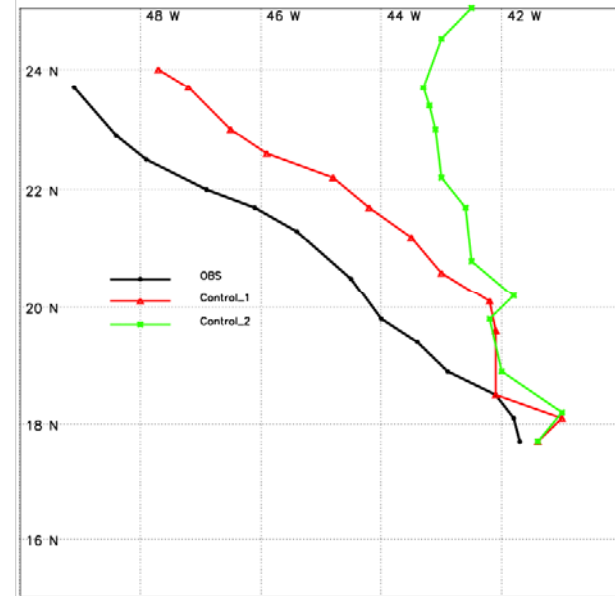
Can be good or bad

Zhaoxia Pu -Joint OSSEs

Some issues with regional OSSEs

Forecast is very sensitive to the boundary conditions

- Exp.1 T799 IC and T799 BC
- Exp.2 T799IC and FNL BC



Concluding remarks

- **Future DLW measurements could be a very useful data source for improving the forecast of high-impact weather systems (e.g., hurricane).**
- **More work needs to be done to explore the better configuration of the observations in order to improve the hurricane intensity forecast.**
- **There are some issues (such as the impact of model physics, boundary conditions, and resolution) that need to be studied carefully with regional OSSEs in order to make a realistic assessment of the impact.**
- **The study is ongoing...**