

The Impact of Airborne Doppler Wind Lidar Profiles on Numerical Simulations of Typhoon Nuri's Formation

Zhaoxia Pu and Lei Zhang

Department of Atmospheric Sciences, University of Utah

David Emmitt

Simpson Weather Associates, Inc.

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Space-based Lidar Winds
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Backgorund

“Tropospheric winds are the number one unmet measurement for improving weather forecasts.”

-- National Research Council

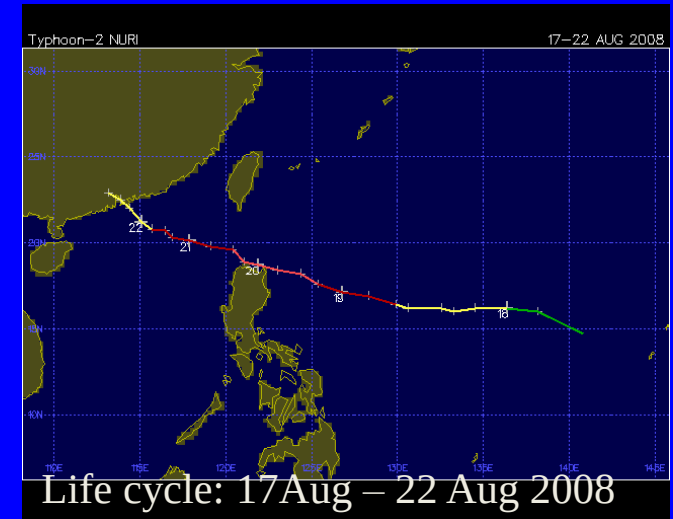
In this talk

- **Demonstrate the impact of Doppler Wind Lidar (DWL) profiles in numerical simulations of tropical cyclones**
- ✓ **Airborne DWL profiles during TPARC/TCS08**

Airborne DWL profiles, collected during TPARC/TCS-08 from ONR P-3

Case

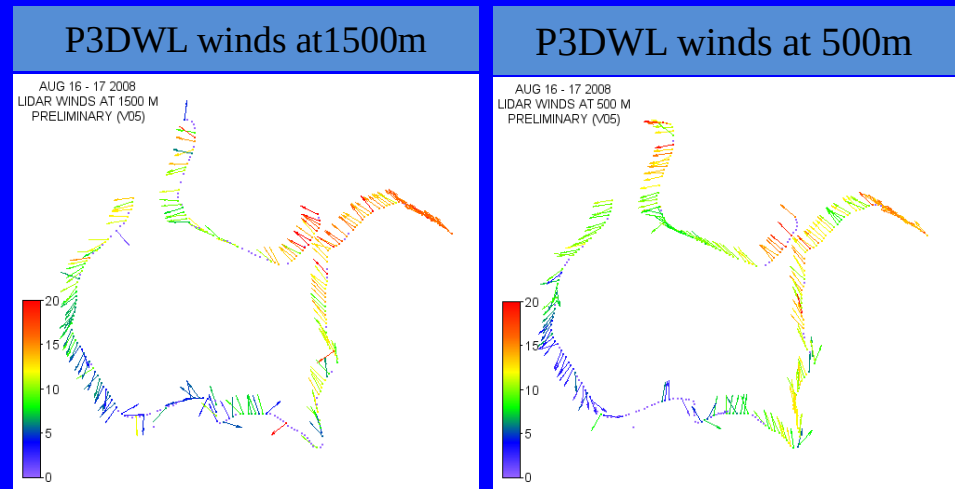
Typhoon Nuri over the Western Pacific



- Wind profiles with 50 m vertical and 1 km horizontal resolution

Time period of data

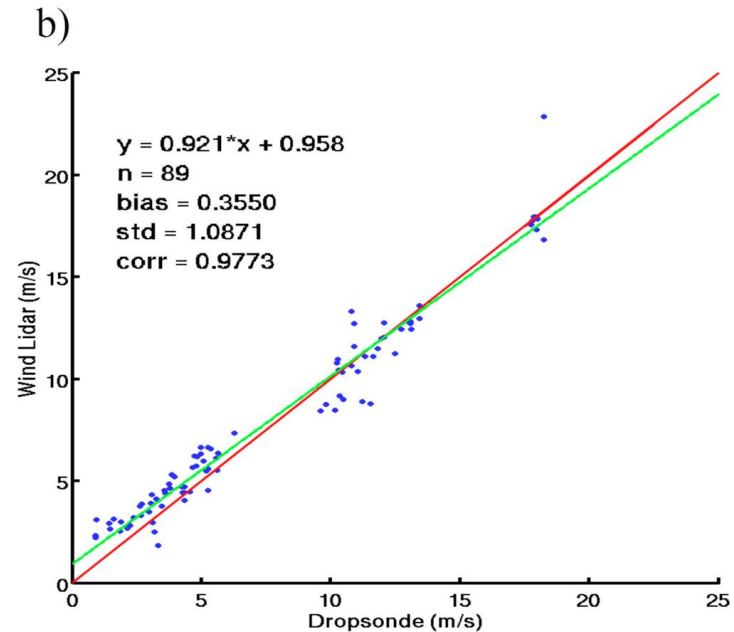
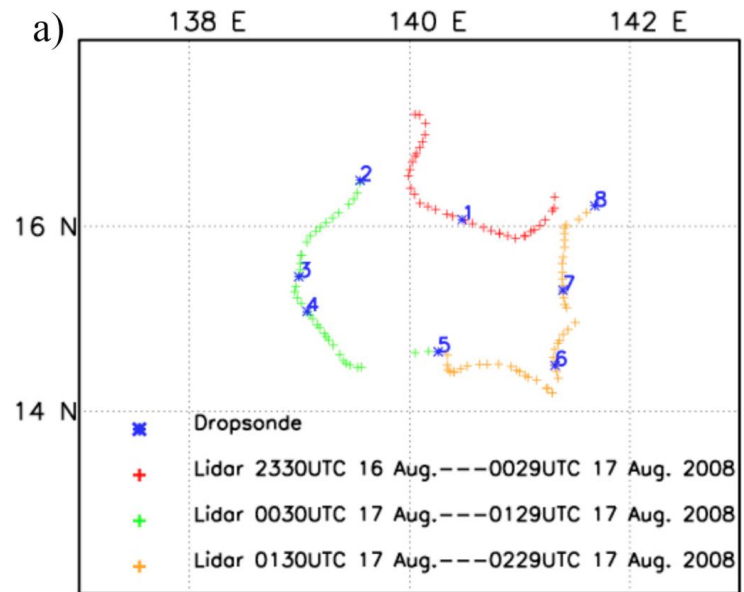
2330UTC 16 August to 0200UTC
17 August 2008 (about 3-h)



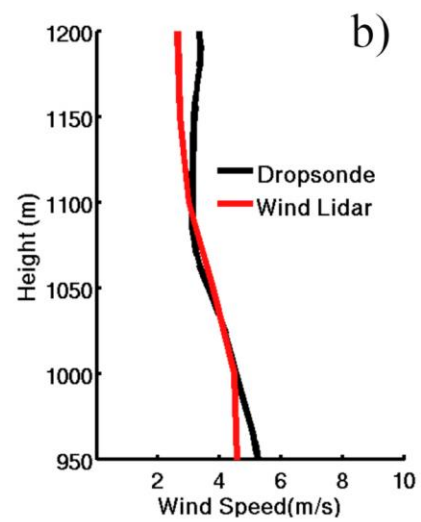
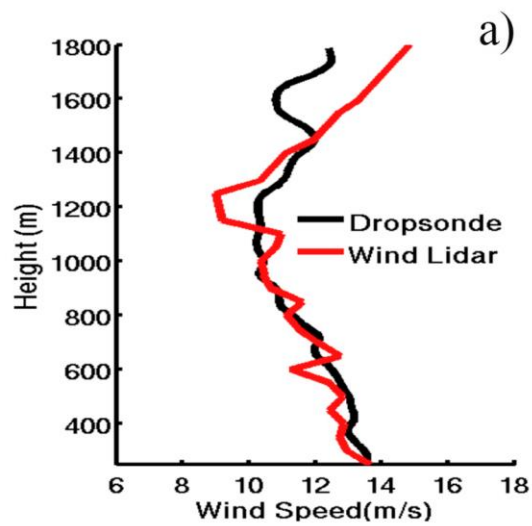
DWL vs. Dropsonde

Quality of the data

**Correlation of wind speed
is nearly 98%**



DWL vs. Dropsonde



Impact study: Data Assimilation Experiments

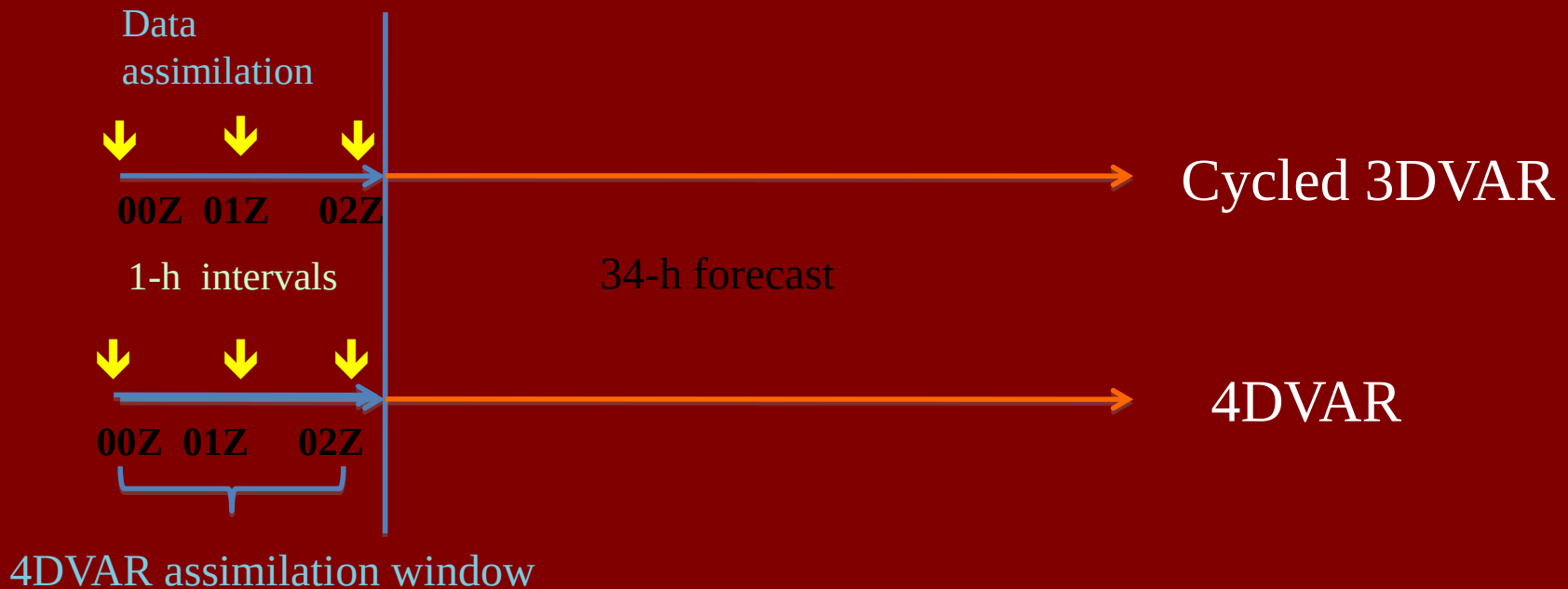
WRF-ARW model: Two-level nested grids (27 km and 9km)

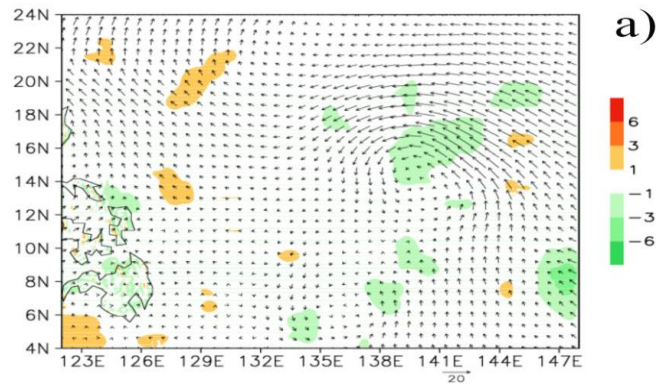
Experiments: “No Data” -- guess field (6 h WRF forecast)

CTRL -- 3DVAR assimilation of conventional
and dropsonde data

3DVAR – 3DVAR assimilation of DWL profiles

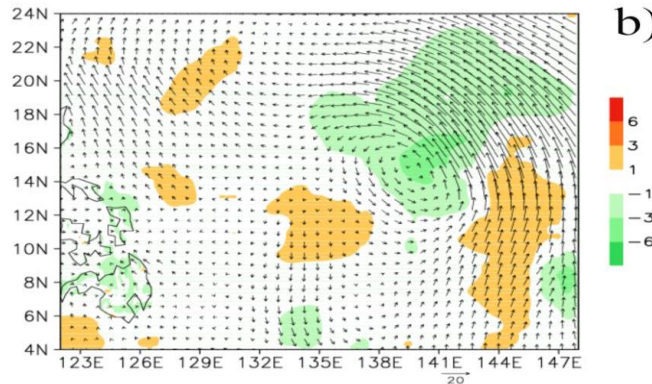
4DVAR – 4DVAR assimilation of DWL profiles





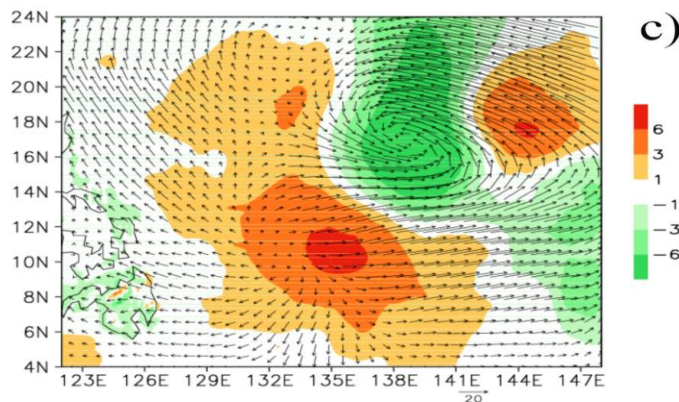
a)

Divergence + Wind
"No Data"



b)

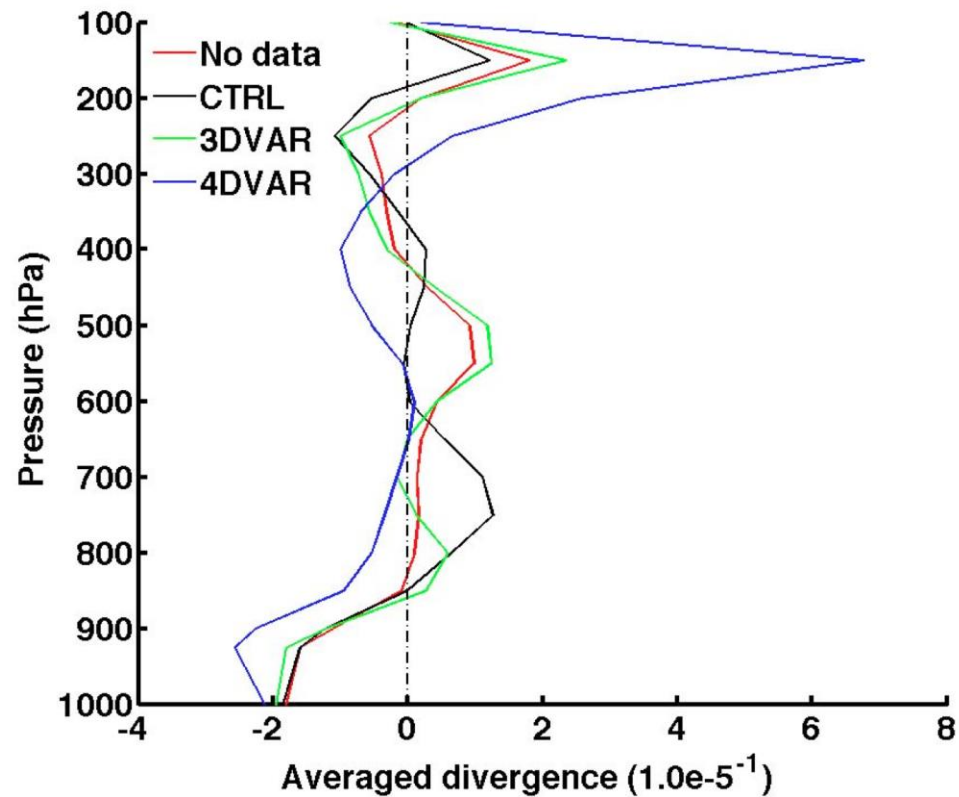
Divergence + analysis
increment of wind
-- "CTRL"



c)

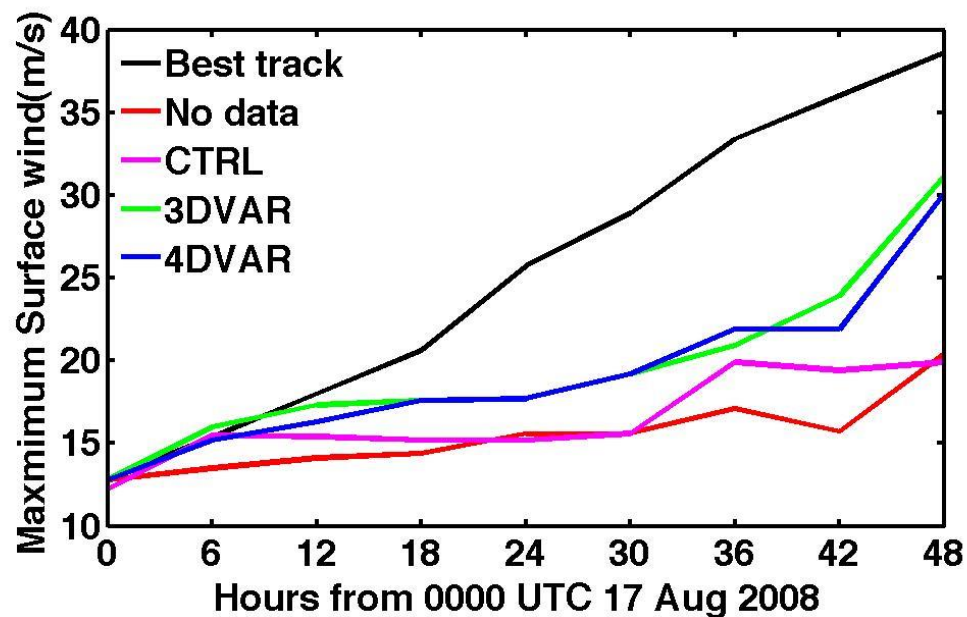
Divergence + analysis
increment of wind
-- "3DVAR"

Use of DWL data enhanced the low level convergence of Nuri in the simulation

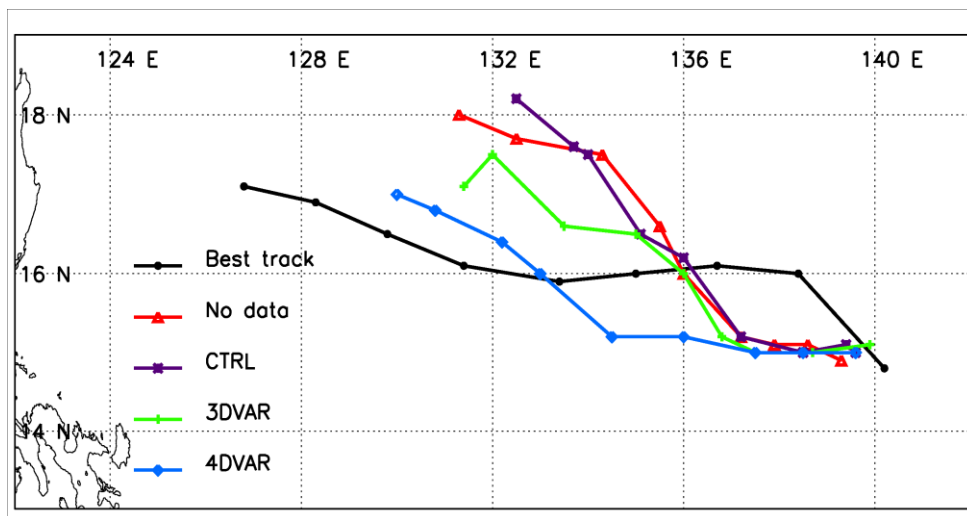


Averaged divergence profiles over the area with radius of 250 km around Nuri's circulation center at 0600 UTC 17 August 2008.

Maximum surface wind of Nuri



DWL data has positive impact on numerical simulation of Typhoon Nuri



Compared with 3DVAR, 4DVAR is deemed to be more promising for assimilating airborne DWL data.

Concluding remarks

- **Airborne DWL profiles are potentially very helpful for numerical forecasting of tropical cyclones**
- **Since the conventional and dropsonde data are very sparse in this study, more realistic comparisons of forecasting impacts from the DWL and dropsonde measurements still await future field experiments when more data become available.**