Convection and Shear Flow in TC Development and Intensification

C.-P. Chang
Department of Meteorology
Naval Postgraduate School, Code MR/Cp
Monterey, CA 93943
Telephone 831-656-2840, e-mail cpchang@nps.edu

H.C. Kuo
Department of Meteorology
Naval Postgraduate School, Code MR/Cp
Monterey, CA 93943
Telephone 831-656-2840, e-mail kuo@lanczos.as.ntu.edu.tw

C. H. Liu
Department of Meteorology
Naval Postgraduate School, Code MR/Cp
Monterey, CA 93943
Telephone 831-656-2840, e-mail ching_hwang@yahoo.com

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LONG TERM GOALS

To study the dynamic processes of tropical cyclone (TC) development in the western North Pacific through field observational data and theoretical modeling.

OBJECTIVES

The objectives are: (1) to study the convection and vorticity generations in the vortex environment that may lead to the development and intensification of tropical cyclone; (2) to study the development and evolution of deep moist mesoscale convective system subject to strain effect due to the horizontal shear associated with the vortex rotation, and the possible offsetting with the convection and vorticity generation; and (3) to study nonlinear interactions that may lead to additional strain effects that may impact on the convection.

APPROACH

During the first year, participate in the TCS08 field phase to conduct flight missions to collect high-resolution radar, lidar, sounding, and in situ aircraft data that describe the evolving kinematic and thermodynamic conditions of mesoscale convection in the vortex environment, and also to perform quick look data processing. In the second and third years these data will be analyzed and used in observational and modeling studies. For the latter we plan to use high resolution cloud model simulations to understand the development of mesoscale convective systems in the environment of significant horizontal strain.

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14. ABSTRACT
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15. SUBJECT TERMS

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WORK COMPLETED

The focus this year was in the field phase data collection. Professor Ching-Hwang Liu and Ph.D. student Mr. Shao-Chin Huang participated in the field program in Guam. They set up workstation and PC onsite and processed data after each P3 research flight. A total of 23 flights were flown and a huge amount of Eldora radar data was collected. The data processing for every one of the flights was very time consuming. The latitude and longitude recorded in the Eldora radar data was taken from the inertial navigation system, which contains a drift when compared to the GPS system. This was resolved by merging the flight level GPS data available from NCAR/EOL/RAF to the Eldora radar to obtain the accurate location. Prof. Liu and Mr. Huang produced the composite radar reflectivity and quick-look dual-Doppler syntheses. Besides serving as the radar scientist including serving as PI for the final flight on board of P3 aircraft, they also worked intensively in the operational center for producing the radar products and uploaded the data to the catalog for use by the community.

RESULTS

We generated the cappi, dBZ composite, dual-Doppler syntheses and RHI images from most of the 23 flights and uploaded to the field catalogue (URL http://catalog.eol.ucar.edu/cgi-bin/tparc_2008/research/index) for all project scientists to use. The link of these Doppler Radar Products is under the following structure:

ELDORA
- Cappi
- dBZcomposite
- dual_Doppler
- rhi

Figure 1 is an example of the dBZ composite of RF14. White line is the P3 flight track and flight level wind is plotted on the composite Eldora radar reflectivity. This allows an easy examination of the convection system that the aircraft has been flown through. Figure 2 is an example of the quick-look dual-Doppler analysis. We have also produced quick-look wind fields for most of the interested areas that the radars have sampled.

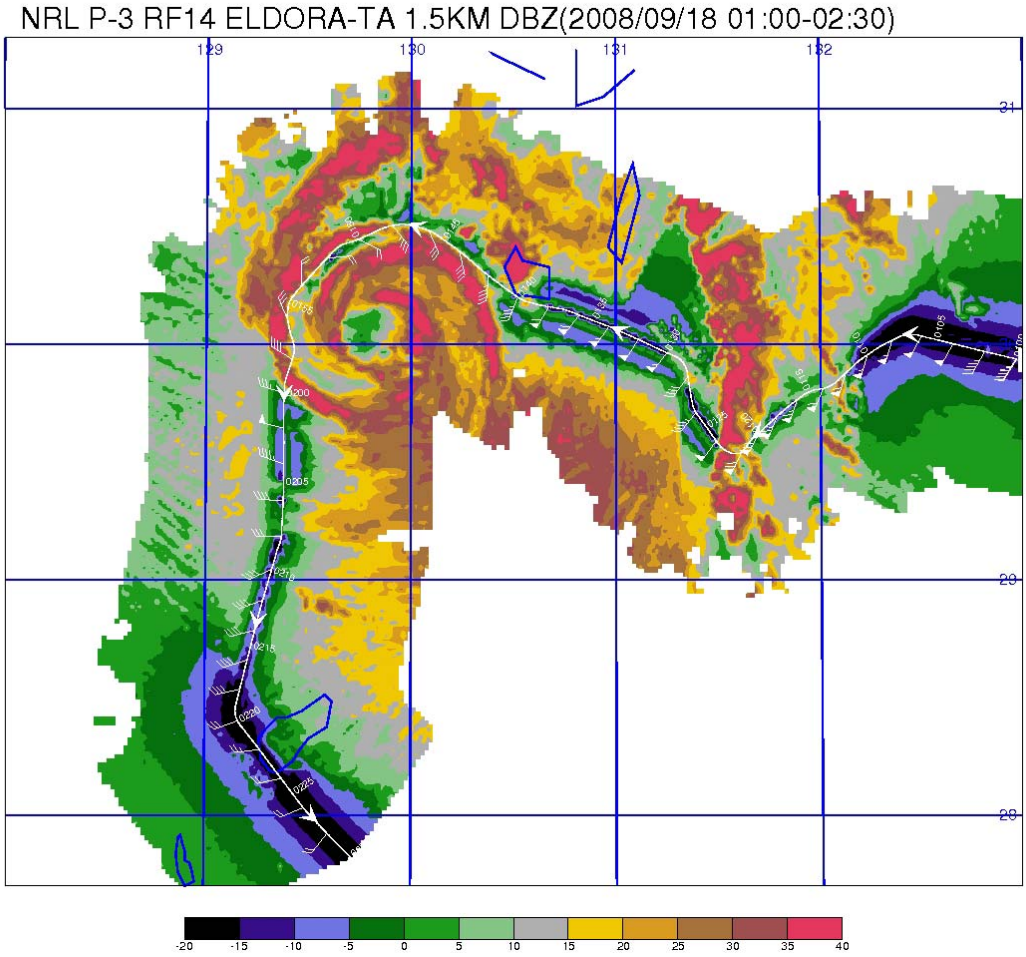

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Figure 1 Eldora radar dBZ composite of RF14. White line is the P3 flight track and flight level wind plotted on top of the composite Eldora radar reflectivity.

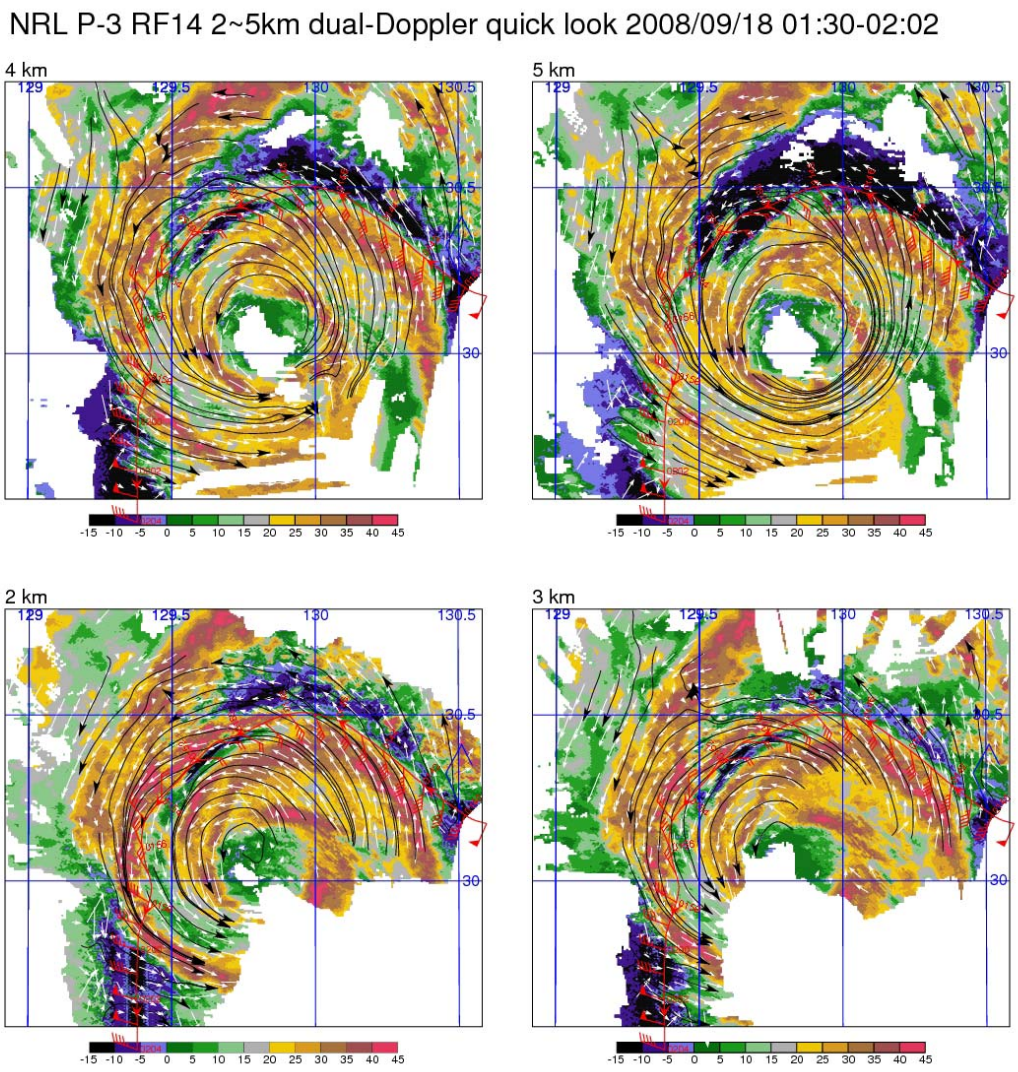

Figure 2 Quick-look dual-Doppler analysis of RF14 at 2km, 3km, 4km and 5km about the sea level. Red line is the P3 flight track and flight level winds.

IMPACT

The data processed from the field phase can be used by all the scientists participating in TCS08 and the general scientific community.

RELATED PROJECTS

TCS08 project led by Professors Russ Elsberry, Pat Harr and Michael Montgomery at NPS.

SUMMARY

Participated in TCS-08 field project, conducted flight observations and processed quick look data set.

PUBLICATIONS

Liu CH: TCS-08 data set including cappi, dBZ composite, dual-Doppler syntheses and RHI. The http://catalog.eol.ucar.edu/cgi-bin/tparc_2008/research/index