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KINEMATICAL CHARACTERISTICS OF THE TROPICAL STORM JULIETTE

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1. INTRODUCTION

Tropical storm Juliette was observed by the NOAA WP3-43 research aircraft on September 21, 2001 in the east Pacific. The aircraft located the center of the storm at about 16.0 UTC. In-situ observations confirmed that Juliette had reached the stage of tropical storm. In the following days it spun up to became a category 4 hurricane. As such, it posed a significant threat to the Mexican west coast.

In this work, we document the characteristics of the vertical profiles of divergence and circulation observed during the tropical storm phase of hurricane Juliette.

2. DATA ANALYSIS

The results we present here are based on data taken by the x-band Doppler radar on-board the NOAA WP-3 aircraft. To collect the data, the airplane penetrated the storm following an an alpha pattern, see Figure 1.

Cartesian velocities are synthesized from Doppler measurements using the method described in Raymond et al. (1997). The winds are obtained in the storm reference frame assuming a translation velocity of (8.44 E, 2.26 N)ms^{-1}. The grid intervals are 1 km and 5 km in the vertical and horizontal, respectively. The grid height is 20 km. The horizontal dimensions are selected to include all radar data collected from 15.3 to 20.6 UTC.

In order to minimize surface clutter, gates in which the main beam is below 500m are discarded. In order to avoid strong specular side lobe reflections, gates within 2.5 km of the aircraft are also not used. The reflectivity threshold is set to 8 dbz.

Smoothed mesoscale wind fields are obtained by performing an objective analysis of the Cartesian winds with a smoothing length of 30 km. From these smoothed fields, we calculate the relative circulation as a function of height. The mass continuity is used to mass-balance each column and obtain the detrained mass flux profile. The net vertical mass flux is obtained by integrating the corrected horizontal mass flux.

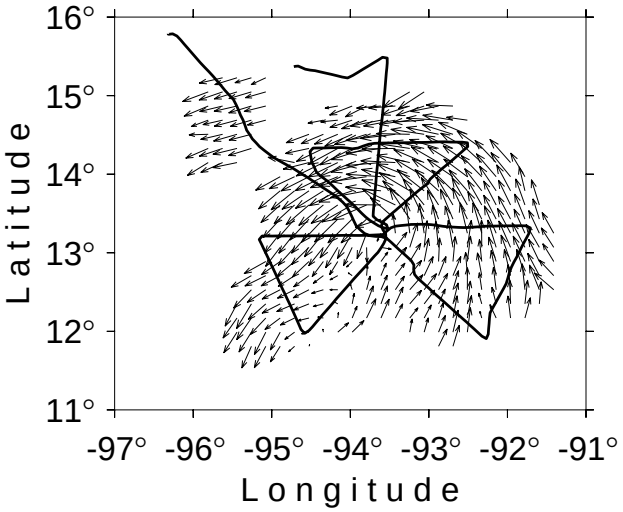

Figure 1: Radar synthesized winds at 3 km height. The black line shows the alpha pattern followed by the aircraft.

3. RESULTS

Figure 2 shows the vertical profiles of various radar-observed quantities for tropical storm Juliette: the inflow layer is 4km deep and the level of maximum updraft is also 4 km. The circulation is strong from the surface to approximately 10 km. The vertical shear is very small throughout the troposphere.

Estimates for the spin tendencies in the system are obtained following Raymond et al. It is found that the spin-down tendency due to surface stress is -8.37798 km^{2}ks^{-2}, and the spin-up tendency due to ingestion of air with absolute vorticity equal to the Coriolis parameter is 22.9452 km^{2}ks^{-2}. This results in a net tendency of 14.5672 km^{2}ks^{-2}.

REFERENCES

Raymond, D. J., C. López-Carrillo and L. López Cavazos, 1997: Case Studies of Developing East Pacific Easterly Waves. *Quart. J. Roy. Meteor. Soc., 124, pp. 2005-2034.*

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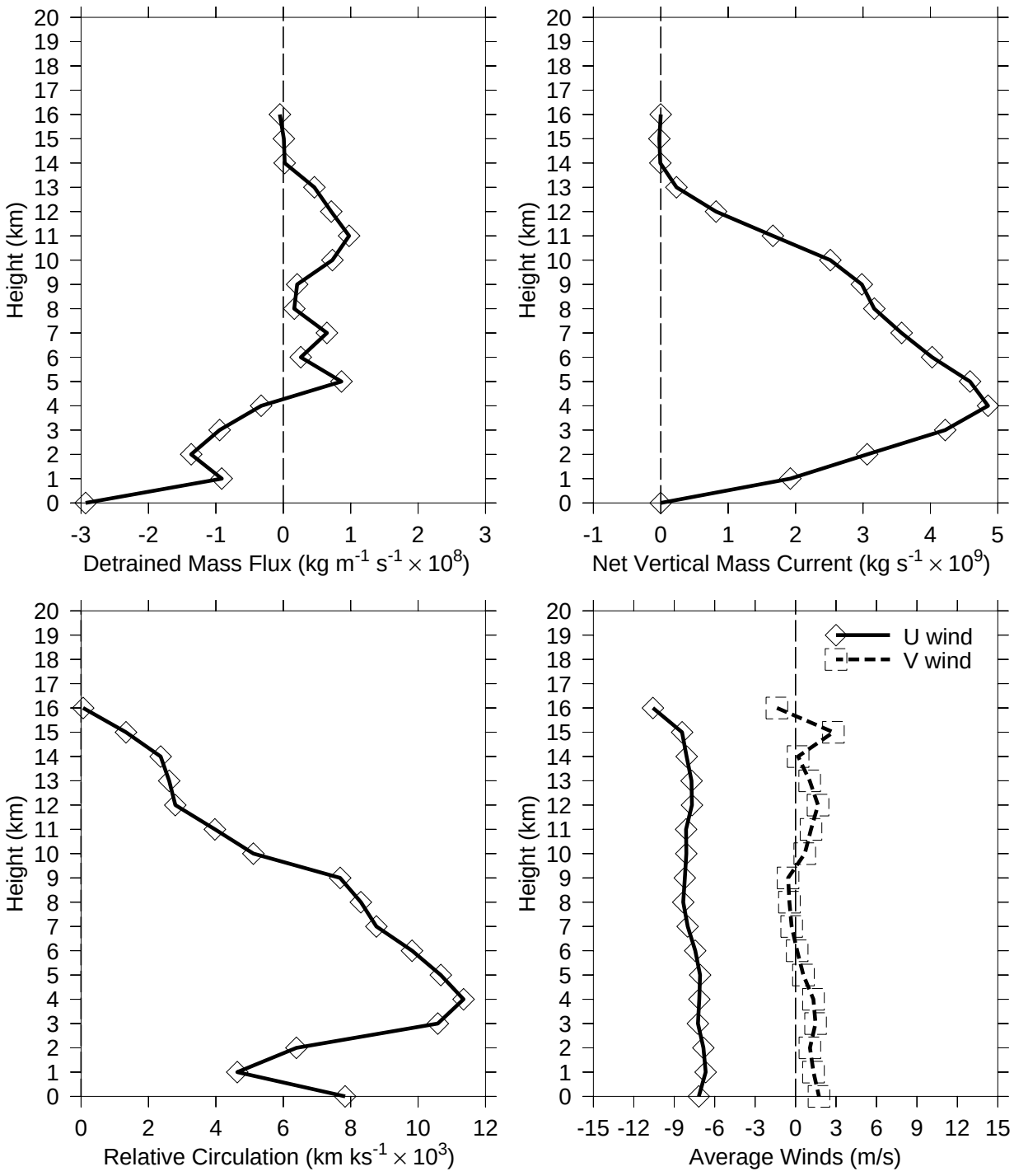

Figure 2: Vertical profiles of various radar-observed quantities for tropical storm Juliette.