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CHARACTERISTICS OF WIND FIELD AND CORIOLIS IN INDONESIA DURING THE EVENTS OF TC CEMPAKA AND TC DAHLIA

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Abstract

In November – December 2017, TC Cempaka and TC Dahlia are sequentially formed in the western region of Indonesia. The occurrence of these tropical cyclones affects the weather dynamics in Indonesia. This study simulates and analyses **the conditions of wind and Coriolis** during the occurrence of TC Cempaka and TC Dahlia. The Global Forecast (GFS) data from 25 November to 3 December 2017 processed using the **Weather Research and Forecasting (WRF) model** to simulate the weather dynamics in the domain resolution 3 km x 3 km per hour, and then analyzed. The results showed that the WRF model used GFS data could simulate the atmospheric conditions in Indonesia during the occurrence of TC Cempaka and TC Dahlia. Wind conditions analysis showed that the formation of **wind convergence** has a pattern following the movement of tropical cyclones. Coriolis force analysis showed that there was a point with a **significant gradient-value** from its surroundings which was identified as the center of the cyclone. This point moved according to the trajectory pattern of the TC Cempaka and TC Dahlia. A comparison of the intensity of its impact on atmospheric dynamics showed that the **TC Dahlia has a stronger effects than TC Cempaka**.

Introduction

Tropical cyclones are an important part of the atmospheric circulation system which plays a role in the transfer of heat from the equator to higher latitudes (Dyahwati et al., 2007). The effects of tropical cyclones can cause **damage** due to strong winds, storm surges, and heavy rain. The Coriolis force is a false (fictitious) style, which appears on the surface of the earth (Tjasyono, 2004). This power causes the cyclone system to move towards the earth's poles. When tropical cyclones occurred, the **rainfall were very heavy** and accompanied by the **high wind speed**. For the forecast of future conditions the atmospheric circulation of knowledge of the current situation is by using dynamic equations both for space and time (Subarna, 2009). A set of prediction equations is the WRF-ARW model which has various choices according to the phenomena studied such as **wind speed and Coriolis** parameters.

Data and Methods

This research was conducted in the southwestern ocean of Sumatra to the southern ocean of Java. Simulation using the WRF-ARW model by using the **Global Forecast System** (GFS) data from NCAR. The simulation running due to the date of the occurrence of the TC Cempaka and TC Dahlia, starting from two days before the events which is **25 November – 3 December 2017** while the domain centered on the event area.

Furthermore, processing the downloaded GFS data due to the required event date, making the grid data to produce wind parameters and the Coriolis parameters by simulated using the WRF-ARW model. The output data from WRF then processed using the GrADS and Python to plot the parameters used.

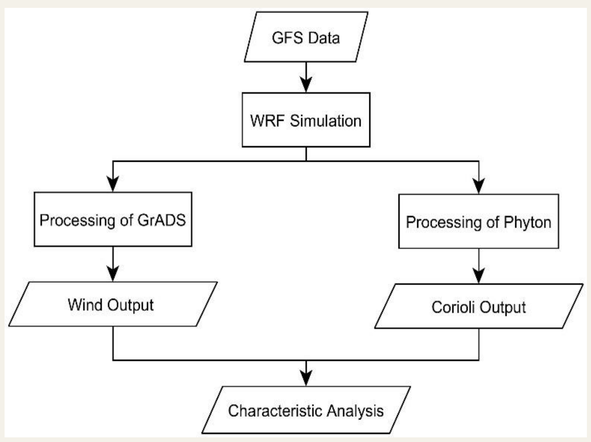

Figure 1. The GFS data processing flow diagram

Results

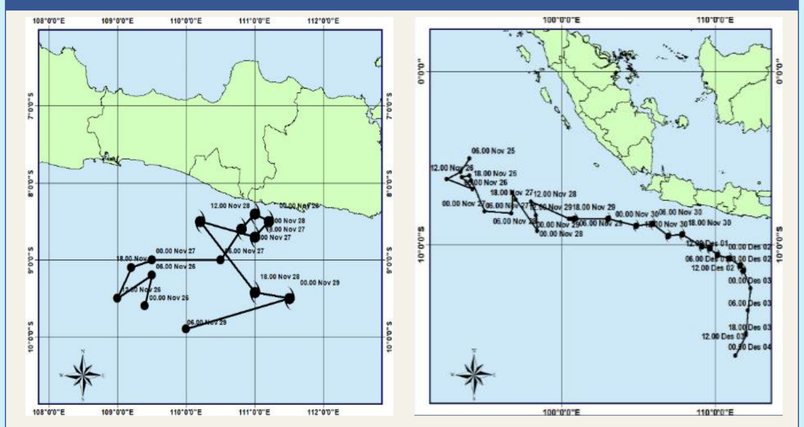

Figure 2. Trajectory of TC Cempaka (left) and TC Dahlia (right)

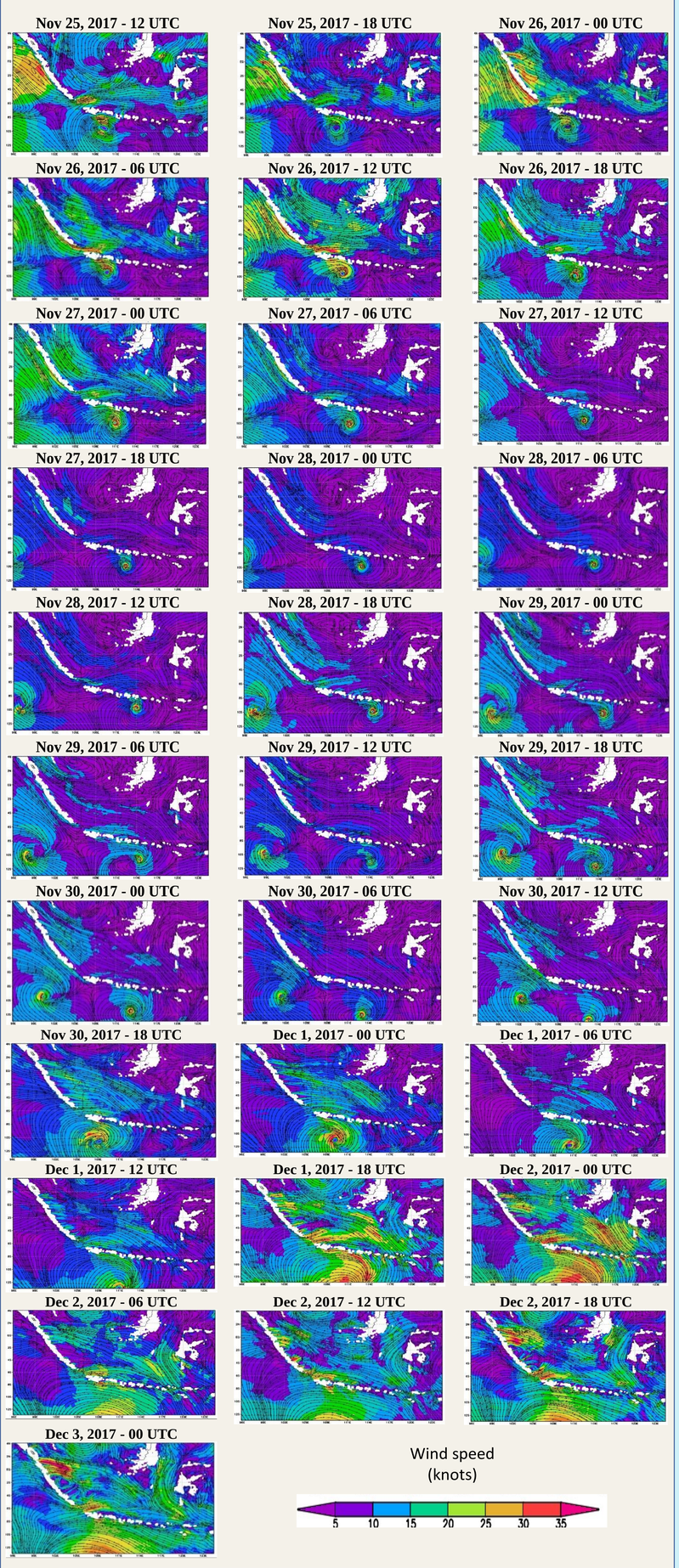

Figure 3. Wind field on 28 November 2017 at 00.00 UTC until 03 December 2017 at 00.00 UTC on Indonesia

Figure 2 show that the **erratic movement** of the TC Cempaka cannot be simulated but its general movement towards the east looks well modeled. Figure 3, TC Cempaka show that the average of maximum wind speed that occured around the center of the cyclone has increased significantly, about **30-35 knots** to more. The movement of the TC Cempaka tends to move eastward and experience a decrease in wind speed and a deflection towards the southwest. Seen in its extinction, TC Dahlia seen were born in the ocean west of Sumatra. The movement of the cyclone eye simulated in the WRF when compared to the actual track. It can be seen that an increase in high wind speed occurs when the Dahlia tropical cyclone in Figure 3 shows an increase in the average maximum wind speed.

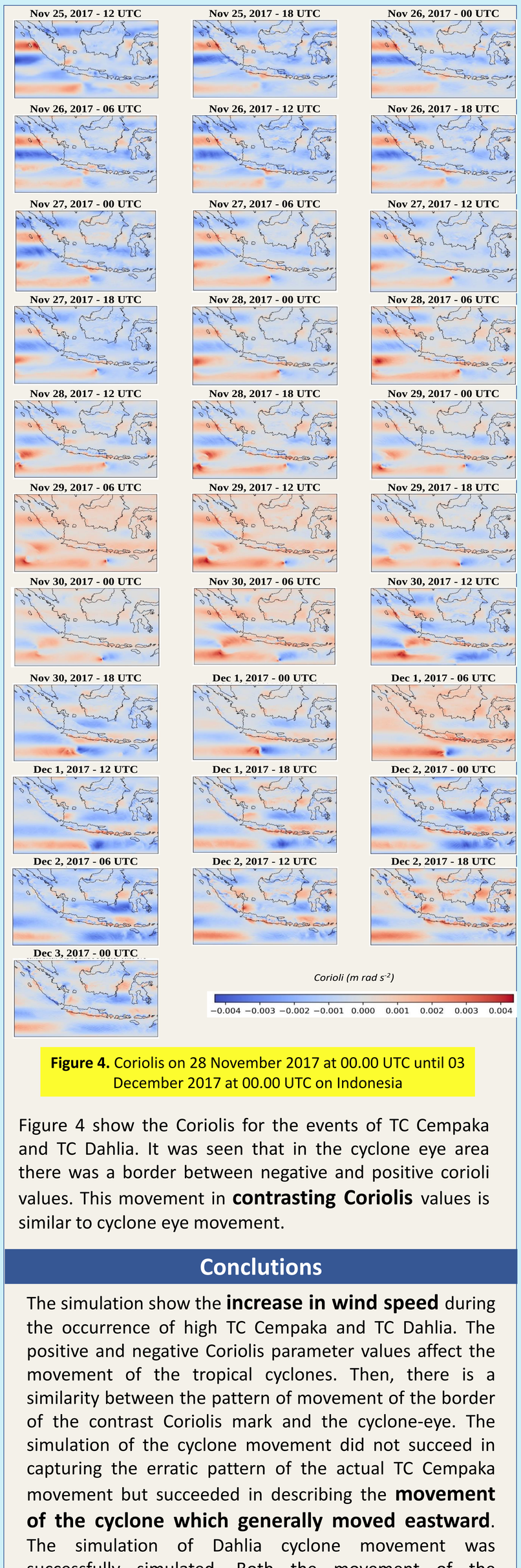

Figure 4. Coriolis on 28 November 2017 at 00.00 UTC until 03 December 2017 at 00.00 UTC on Indonesia

Figure 4 show the Coriolis for the events of TC Cempaka and TC Dahlia. It was seen that in the cyclone eye area there was a border between negative and positive corioli values. This movement in **contrasting Coriolis** values is similar to cyclone eye movement.

Conclutions

The simulation show the **increase in wind speed** during the occurrence of high TC Cempaka and TC Dahlia. The positive and negative Coriolis parameter values affect the movement of the tropical cyclones. Then, there is a similarity between the pattern of movement of the border of the contrast Coriolis mark and the cyclone-eye. The simulation of the cyclone movement did not succeed in capturing the erratic pattern of the actual TC Cempaka movement but succeeded in describing the **movement of the cyclone which generally moved eastward**. The simulation of Dahlia cyclone movement was successfully simulated. Both the movement of the simulation results and the track is actually similar.

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