Chapter 10
Analysis the Typhoon Eyes of Megi from MTSAT Satellite Cloud Images with 3-D Profile Reconstruction

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ABSTRACT

In this paper, image reconstruction technique (IRT) is used to reconstruct a 3-D profile of typhoons from MTSAT satellite cloud image data and based on a 1691 MHz receiver and iDAP system. The satellite cloud image data gives a single line profile slicing from a surface cloud image which does match the typhoon distribution. The line profile is presented with the temperature of the cloud top. The 3-D profiles of typhoons are constructed with the surface cloud images and the temperatures. IRT is conducted using the data of the 2010 Megi event. The typhoon feature is studied and the various typhoon eyes in three time intervals are analyzed. An effective early-warning system may become feasible based on this work.

INTRODUCTION

The distribution of typhoon and its variation are very important for disaster prevention and worthy of study. The satellite data provides typhoon cloud image for analyzing the cloud structure and wind driven velocity of typhoon. The current geostationary satellites provided typhoon cloud image for weather broadcasting include US GOES-11 and GOES-12, Japan MTSTAT-1R, Dartcom, (http://www.dartcom.co.uk), Japan Meteorological Agency (http://www.jma.go.jp), Europe METEOSAT-6,7,8, China FY2, and METEOSAT-5 in Indian ocean. The typhoon cloud images are

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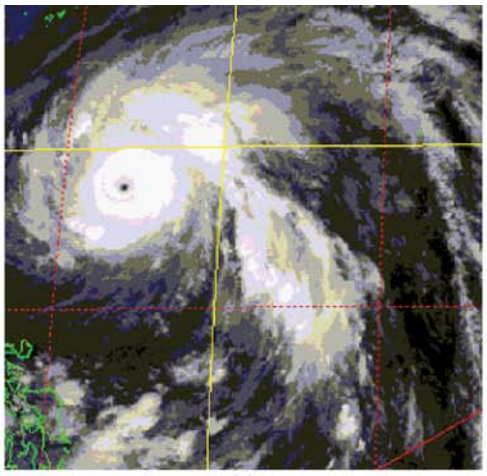
not clear often, there are many kinds of noise in it, which may affect to accurately segment the helical cloud band or extract some information from the typhoon cloud images. Both noise reduction and contrast enhancement are usually applied in a typhoon cloud image for location, rotation, tracking, and forecast (Pun, Lin, Wu, Ko, & Liu, 2007; Pao, Yeh, Liu, & Hsu, 2006; Pao & Yang, 2008; Qian, Jiang, Zhang, & Wang, 2010; Qian & Jiang, 2011; Tsai, Hwang, Chen, & Lin, 2010; Wu, 2001; Wang, Guo, & Luo, 2006; Wang, Yang, Li Li, & Lu, 2005; Xu, Wang, & Xie, 2009; Wang, Xu, Shi, & Ye, 2008; Yeh, Pao, Lee, & Lai, 2007; Zhang, Lu, Lu, & Xu, 2008; Zhang & Wang, 2009; Zhang & Yang, 2011; Zhang, Lai, Wei, & Zong, 2006).

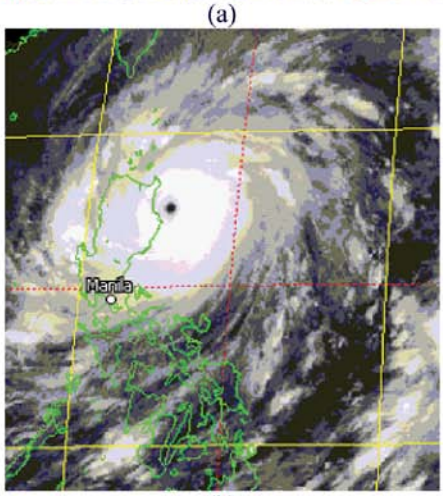
Recently, the typhoon eye is the interested behavior for research (Pun, Lin, Wu, Ko, & Liu, 2007; Pao, Yeh, Liu, & Hsu, 2006; Zhang & Wang, 2009; Zhang, Lai, Wei, & Zong, 2006). Since the portion surrounding the eye will do the most damage, the typhoon center recognition is important for weather forecast and typhoon analysis. When the typhoon reaches to certain strength, there will be an eye appeared at the center. As the strength of the typhoon getting stronger, the eye tends to a circle and also becomes clearer. When the typhoon arrive the land, its strength will decrease and the eye may be non-clear. However, the typhoon cloud images are planar pictures. Recently a 3-D profile reconstruction is an interesting research topic for recognizing the practical typhoon. The segmentation of the satellite cloud image was sliced in horizontal plane to obtain a series of 2D surfaces, and reconstruct the 3D cloud or storm (Somporn, Willi, Hans, Susanne, Wattana, & Suchada, 2008).

Based on the vertical segmentation, IRT is used to reconstruct a 3-D profile of typhoons from MTSAT satellite cloud image data in this paper. The objectives of this paper are three fold: first, to slice the line profile from that satellite cloud image data and present the height variations under the conversion of the temperature; second, to construct the mesh-amplitude model in

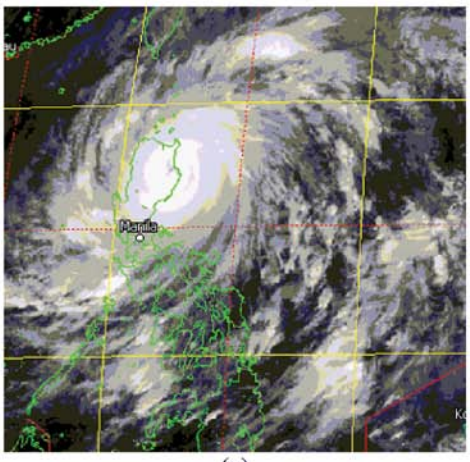
Figure 1. Three cloud images of Megi typhoon: (a) first interval, (b) second interval, (c) third interval



(a)



(b)



(c)

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