CHAPTER 1
INTRODUCTION

1.1 Rationale

The Indochina peninsula (IDP) is a geographically unique entity situated between the Indian subcontinent and East Asia, where two contrasting Asian monsoon systems exhibit distinct characteristics (Wang, 2003; He, 2007). During the boreal winter, the climate condition over the IDP is dominated by the meridional circulation associated with the intensified Siberian high (SH) (Chen, 2000; Wangwongchai, 2005). It is generally characterized by ascending warm air over the Indonesian maritime continent and descending cold continent air over China, resulting in two major branches of low-level wind fields blowing toward the subtropical western Pacific and South China Sea (Chen, 2000). A succession of northeasterly surges with outbursts of SH is one of the most conspicuous features of the East Asian winter monsoon (EAWM) (Ji, 1997). The active EAWM exerts a strong impact on the extratropical and tropical planetary-scale circulations and influences the convection over the tropical western Pacific (Ji, 1997), and its variability is linked to the forcing from sea surface temperature anomalies in the tropical Pacific Ocean (Ji, 1997; Zeng, 2011). Available evidence has indicated that the variability of EAWM exert social-economic impacts on many Asian countries (Ji, 1997; Chen, 2000; Wangwongchai, 2005). Hence, a better understanding of EAWM variability is still of great scientific challenge and public concern.

The variability of EAWM can be characterized, and its strength can be measured by the behaviour of many climatic parameters (Ji, 1997; Lu, 1999; Chen, 2000; Liu, 2012; Wang, 2010). To further extend our current understanding, the relationship between EAWM indices and winter-time wind representing winter monsoon over the IDP is of great interest because the IDP is tropical regional scale which has different climate feature from the large scale. Furthermore, due to the fact that the winter monsoon variability over the IDP has been studied less extensively compared to its summer counterpart (Zhang, 2002; He, 2007; Yokoi, 2007; Takahashi, 2010, 2011). These are of importance for the IDP countries, and their neighbours.

It is widely accepted that sea surface temperature (SST) variability in the equatorial Pacific Ocean plays an important role on atmospheric processes and climate variability.

Many previous studies have shown that SST variability associated with the El Niño-Southern Oscillation (ENSO) events strongly affects the EAWM (Zhang, 1997; Wang, 2000; Zhou, 2007; Zeng, 2011). Thus, there is possibility to have some roles of the SST variability playing on winter monsoon over the IDP.

This study aims to analyse the monthly gridded data using an analysis of the empirical orthogonal function for complex numbers to reveal spatio-temporal structures of wintertime winds over the IDP, and to disclose any possible connections to the EAWM. The relationships between the SST and winter monsoon over the IDP are further illustrated. These analyses aim at providing empirical evidence in supporting more understanding of winter monsoon over the IDP, demonstrating some connections to the EAWM and its association with SST variation.

1.2 Literature Review

Emphasizing on the studies related to the Indochina Peninsula, the rainfall variation in terms of intraseasonal variation over the Indochina peninsula was analysed with daily rain gauge data. The variance of 30-60 day is larger in coastal areas than over inland areas, while 10-20 day variance shows spatial coherence over most of the Indochina peninsula (Yokoi, 2007). The diurnal variation of the peninsula was classified into three patterns of rainfall peak as follows: 1) early afternoon rainfall caused by the convergence of thermally induced upslope winds, 2) evening rainfall occurred at shaped plains of Cambodia, north of Bangkok, and the valley between the Pegu and Dawna mountain ranges, caused by convergence and land-lake circulation depending on area characteristic, and 3) early morning rainfall. Heavy early morning rainfall mostly occurs over the areas of the coasts of the eastern Bay of Bengal, the eastern Gulf of Thailand, and the eastern Khorat Plateau (Takahashi, 2010). For a study which emphasizes that Thailand is a member country of the IDP, the summer monsoon rainfall in Thailand is higher than normal condition during the strengthening of the Indian summer monsoon, and lower than normal during the weakening of the Indian summer monsoon. For the relation to the western North Pacific summer monsoon, more rainfall in the north-eastern part of Thailand presents during the strengthened monsoon, and less rainfall in the central part of Thailand during the weakened monsoon (Limsakul, 2010).

However, studies of the monsoon over the Indochina Peninsula have mostly emphasized the Asian Summer Monsoon or the wet season (Matsumoto, 1997; Chen et al.,

2000; Yaocun et al., 2002; Yokoi et al., 2007; Takahashi et al., 2010), and have less EAWM information.

1.3 Literature Review

This study aims to achieve the objectives for the Indochina peninsula as follows:

1. To analyze monsoon variability and its strength,

2. To describe the linkages of the monsoon to ENSO and IOD, and

3. To determine the possible impacts of the monsoon associated with ENSO and IOD.

1.4 Scope of Work

The implementation of this work focusing on the EOF analysis of low-level zonal and meridional wind components during the boreal winter for the IDP with a period of study at least 30 years to reveal winter-time wind variability representing the winter monsoon over the IDP. Next is looking for the relation between the winter-time wind variability and SST variability in the Pacific and Indian Oceans leading to describe the possible linkage of the winter monsoon over the IDP to ENSO and IOD. In case there are some linkages, the analysis of their occurrences was performed to show the association by coincident events with presenting the possible impacts of the winter monsoon on the precipitation and the surface temperature in the IDP.