

# CHAPTER 5 CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion

The objective of this research is to investigate fluctuation of summer monsoon winds both at the surface and 850 hPa level (about 1.5 km above the ground). Fractal dimension is used to measure fluctuation in wind speed and direction. A new method for fractal dimension approximation called the improved variation method (IVM) is proposed in this research. IVM is developed from the variation method (VM) by reducing the excessive area that is created when the reduction factor is large.

The surface wind data are obtained from 5 Meteorological Centers of the Thai Meteorological Departments (TMD). The locations of these centers are at Chiang Mai (CM), Ubon Ratchathani (UB), Phuket (PK), Songkhla (SK) and Bangkok (BK). The 850 hPa wind data are from the National Centers for Environmental Prediction (NCEP). The 850 hPa wind data from NCEP are on 1.0×1.0 degree grids and available for every 6 hours, while the surface wind data from TMD are available for every 3 hours.

The fractal dimension analyses are divided into two main experiments; 10-year and yearly cases, using 10-year time series of summer monsoon wind (mid-May to mid-October) during the year 2003 to 2012. The experiments are further divided into 6-hourly, daily maximum and daily minimum cases.

Results of fractal dimension approximations by VM and IVM show that the fractal dimension obtained from IVM is slightly more than that of VM. This is a direct consequence of IVM that reduces the error associated with the excessive area in the original VM.

Results show that fractal dimensions of speed and direction of 850 hPa wind are less than those of surface wind. This is due to the fact that at 850 hPa level is free from the influence of earth surface.

A large fractal dimension means a high fluctuation of wind. The 10-year and yearly largest fractal dimensions are summarized in Tables 5.1 and 5.2.

**Table 5.1** 10-year largest fractal dimensions of wind speed and direction.

10-year	Speed		Direction		
	Surface	850 hPa		Surface	850 hPa
6-hourly	1.305 UB	1.227 BK		1.294 UB	1.241 BK
Daily Max	1.295 CM	1.225 UB	1.225 BK	1.323 CM	1.245 SK
Daily Min	1.334 SK	1.234 BK		1.336 SK	1.241 BK

**Table 5.2** Yearly largest fractal dimensions of wind speed and direction.

Yearly	Speed			Direction	
	Surface	850 hPa		Surface	850 hPa
6-hourly	1.261 UB (2005)	1.249 BK (2004)	1.249 PK (2010)	1.335 UB (2005)	1.290 BK (2012)
Daily Max	1.347 CM (2005)	1.282 UB (2008)		1.390 UB (2004)	1.282 UB (2008)
Daily Min	1.392 CM (2010)	1.290 BK (2008)		1.411 SK (2004)	1.312 PK (2004)

## 5.2 Recommendation

1. Fractal analysis should be done for winter monsoon wind for the purpose of comparison with the summer monsoon wind over Thailand.
2. Fractal dimension of rainfall time series over Thailand should also be analyzed to investigate the relationship between the fluctuation in wind and rainfall.