CHAPTER 4 RESULT

4.1 Value of Shape Parameter (γ) for Symmetric Wind Model

The value of shape parameter (γ) for velocity distribution of wind outside the eye of the storm is calculated from Equation (2.16) and shown in Tables 4.1-4.2.

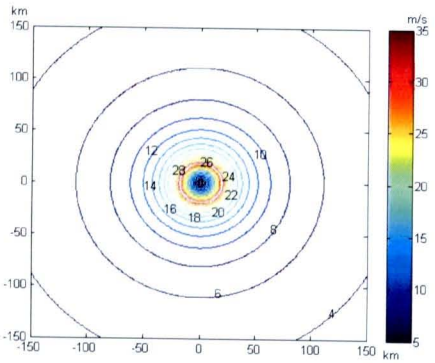
Table 4.1 Parameter γ for Gay.

No	Date/Time	Radius of Maximum Wind (R_{max})(m)	Radius of Tropical Cyclone (r) (m)	Observed Maximum Wind speed (V_{max}) (m/s)	Observed Wind speed (V) (m/s)	Parameter γ
1	2/11/1989/03	18520	111100	17.5	6.2	0.6
2	2/11/1989/06	18520	111100	20.5	7.3	0.6
3	2/11/1989/12	18520	111100	20.5	6.8	0.6
4	2/11/1989/18	18520	111100	23.1	7.5	0.6
5	3/11/1989/00	27780	111100	23.1	8.0	0.7
6	3/11/1989/06	27780	148200	28.2	7.5	0.7
7	3/11/1989/12	37040	185200	30.8	6.2	0.9
8	3/11/1989/18	37040	185200	33.4	7.5	0.9
9	4/11/1989/00	37040	185200	38.5	7.0	1.1
10	4/11/1989/06	37040	185200	33.4	7.3	0.9
11	4/11/1989/12	37040	185200	30.8	6.2	0.9

Table 4.2 Parameter γ for Vamei.

No	Date/Time	Radius of Maximum Wind (R_{max})(m)	Radius of Tropical Cyclone (r)(m)	Observed Maximum Wind speed (V_{max})(m/s)	Observed Wind speed (V) (m/s)	Parameter γ
1	27/12/2001/00	37040	185200	20.5	7.4	0.6
2	27/12/2001/06	46300	222240	23.1	8.3	0.6
3	27/12/2001/12	37040	185200	18.0	7.2	0.5

From Tables 4.1 and 4.2, the parameter γ is in the range of $0.5 < \gamma < 1.1$ in the Gulf of Thailand.



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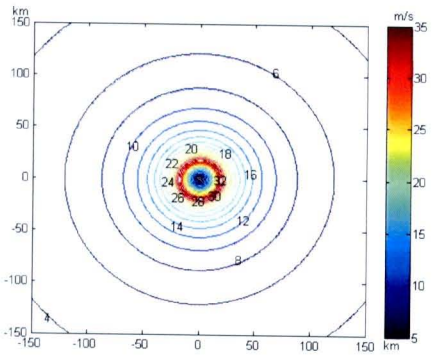

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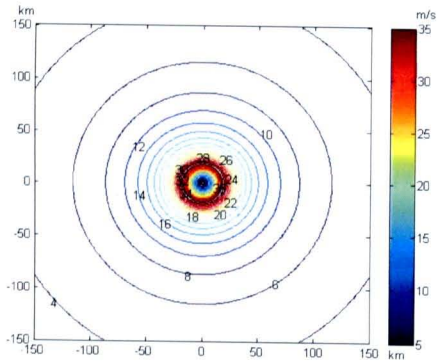

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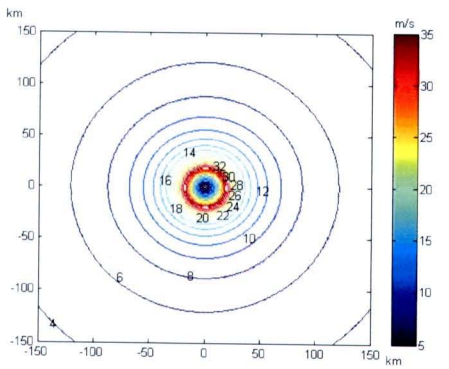

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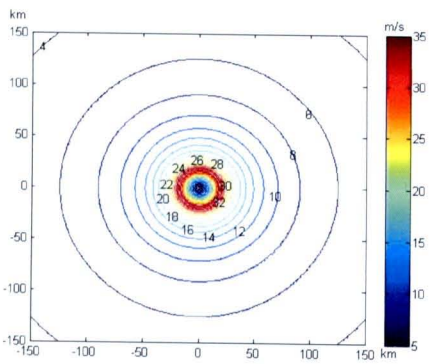

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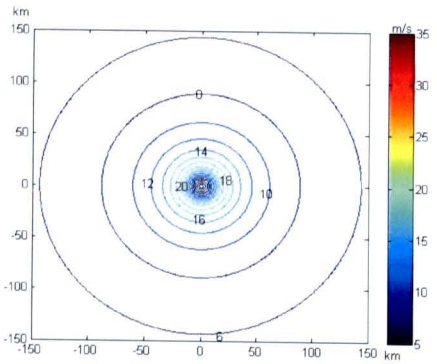
Figure 4.1 Symmetric wind speed for Gay (m/s) (continued).



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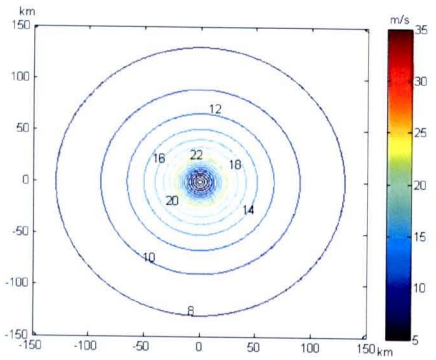

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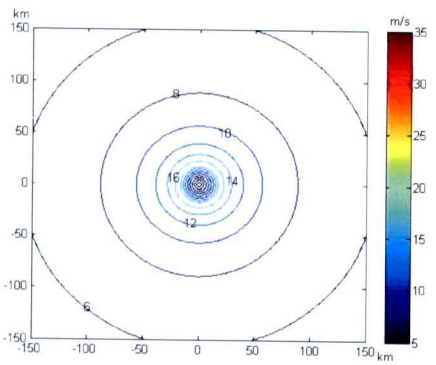
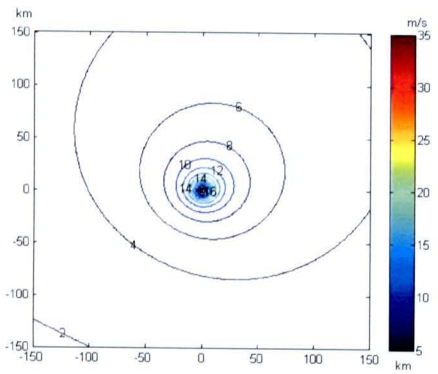


27/12/2001 at 1200UTC

Figure 4.2 Symmertic wind speed for Vamei (m/s).

4.3 Asymmetric Wind Speed

The asymmetric wind obtained from Equation (2.11) is shown in Figures 4.3-4.4.



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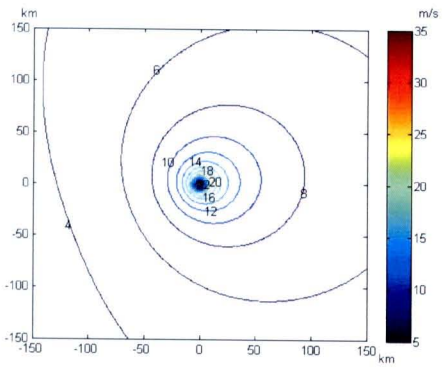

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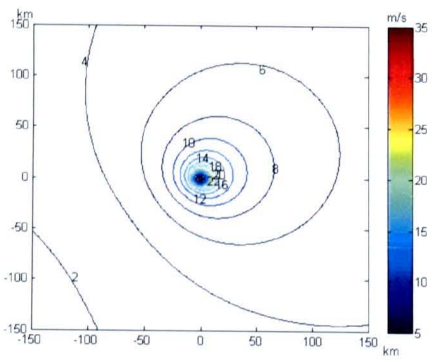

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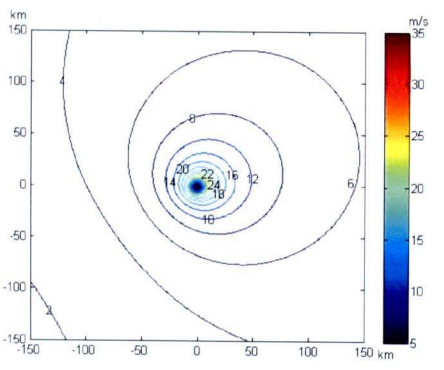

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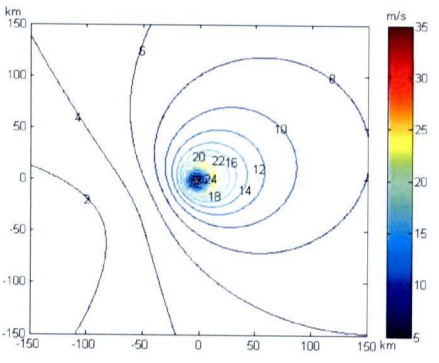

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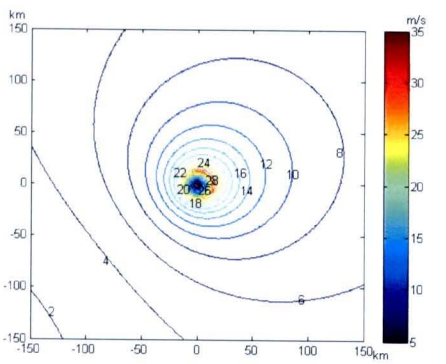

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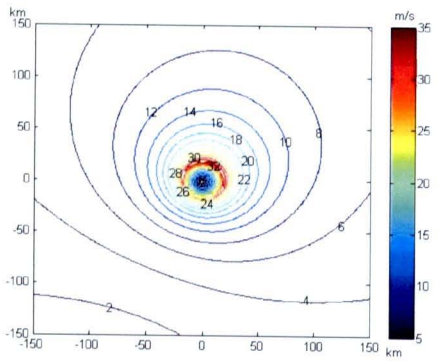
Figure 4.3 Asymmetric wind speed for Gay (m/s).



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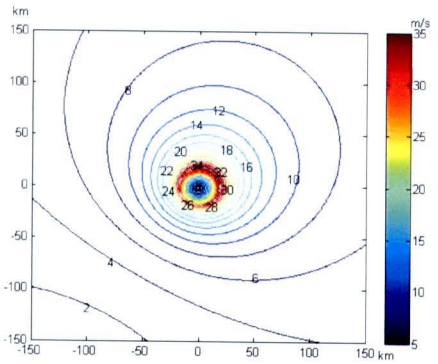

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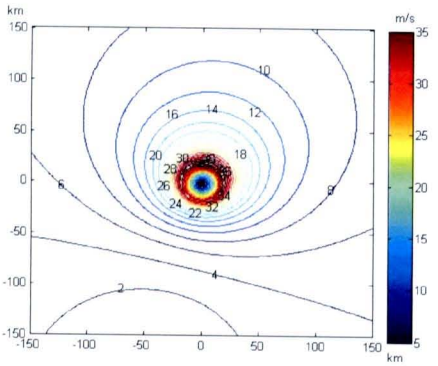

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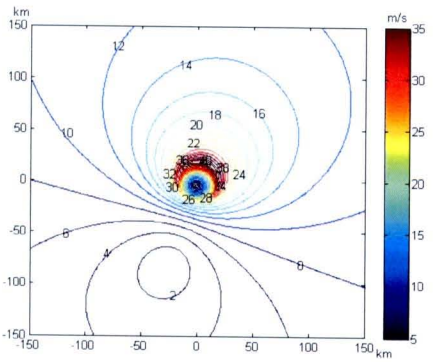

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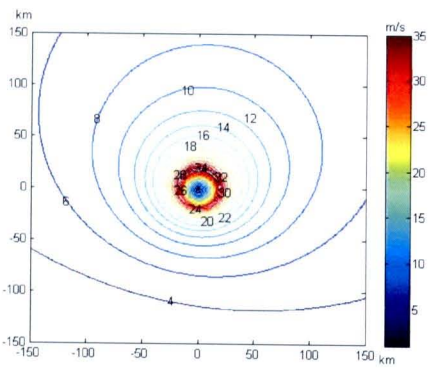
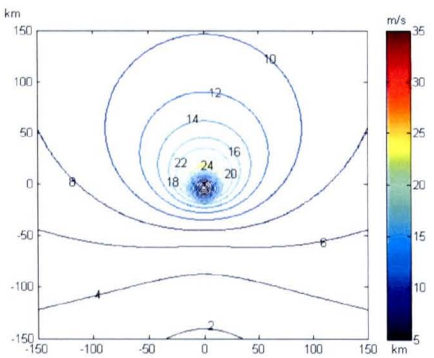


04/11/1989 at 1200UTC

Figure 4.3 Asymmetric wind speed for Gay (m/s) (continued).



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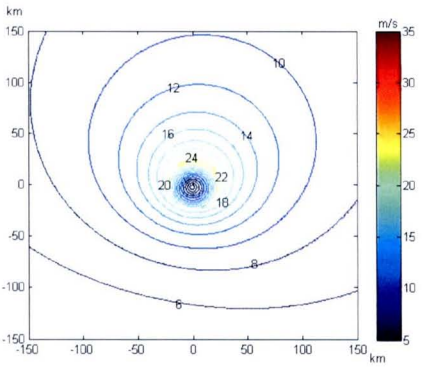

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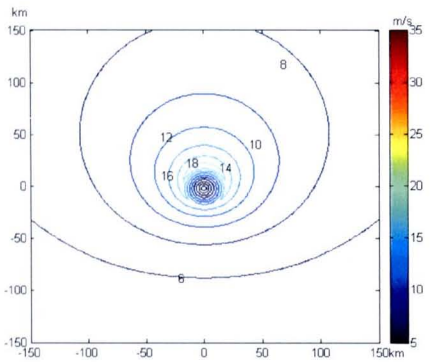
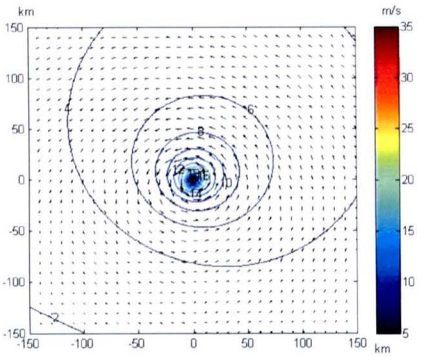


27/12/2001 at 1200UTC

Figure 4.4 Asymmetric wind speed for Vamei (m/s).

4.4 Wind Field from Asymmetric Model

Wind speed and wind vector distributions from the asymmetric wind model for Gay and Vamei are shown in Figures 4.5 and 4.6.



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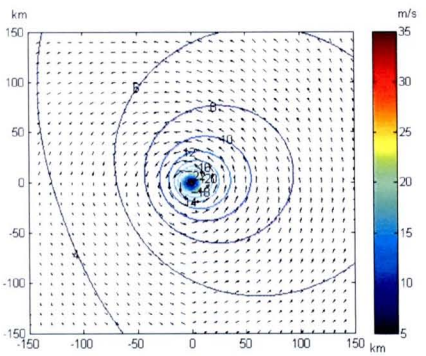

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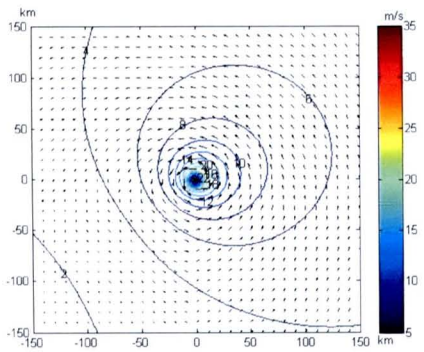

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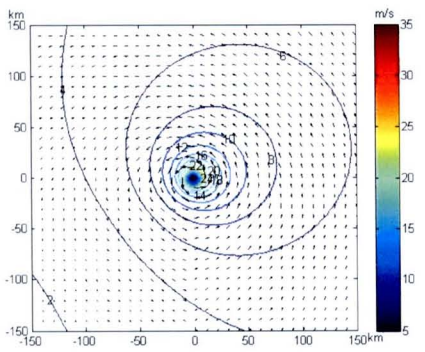

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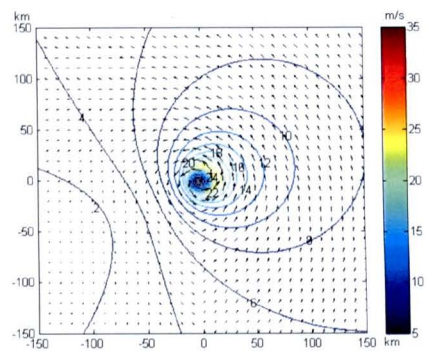
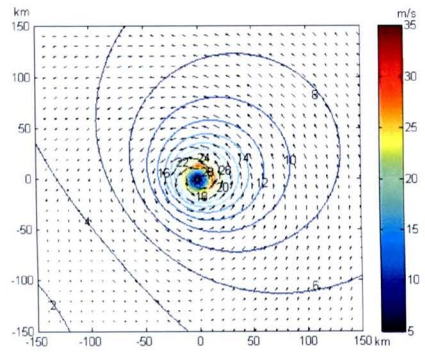
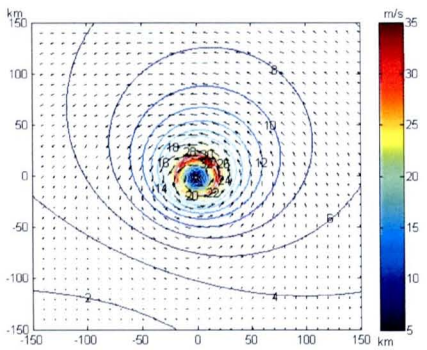


03/11/1989 at 0000UTC

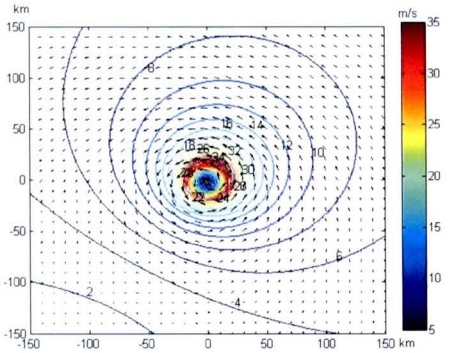


03/11/1989 at 0600UTC

Figure 4.5 Wind speed and wind vector for Gay from the asymmetric wind model.



03/11/1989 at 1200UTC



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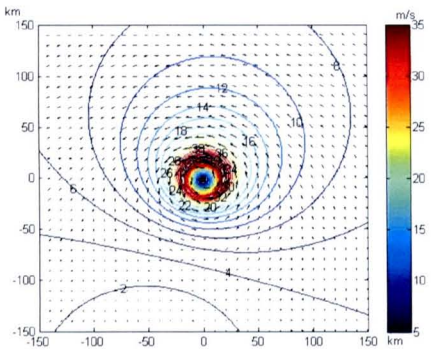

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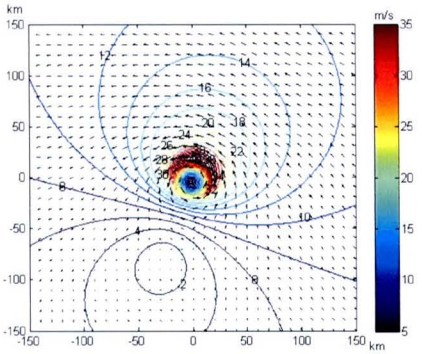

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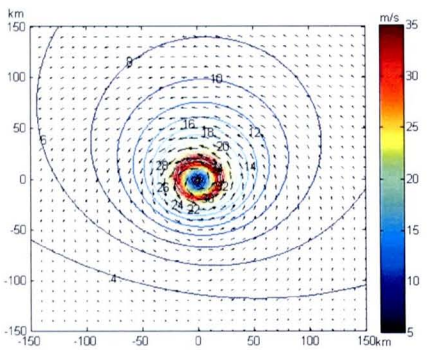
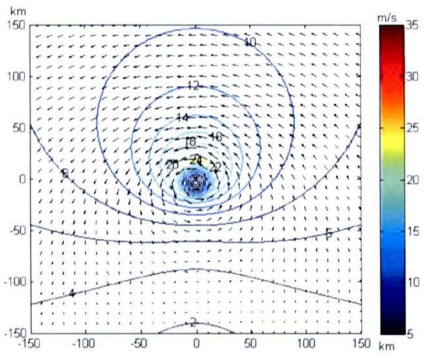


04/11/1989 at 1200UTC

Figure 4.5 Wind speed and wind vector for Gay from the asymmetric wind model (continued).



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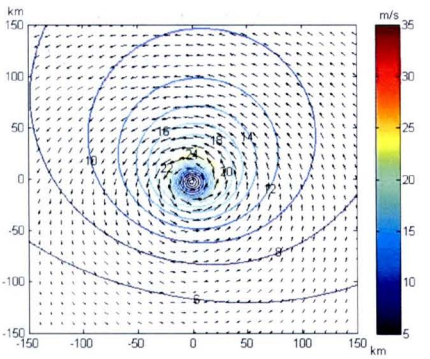

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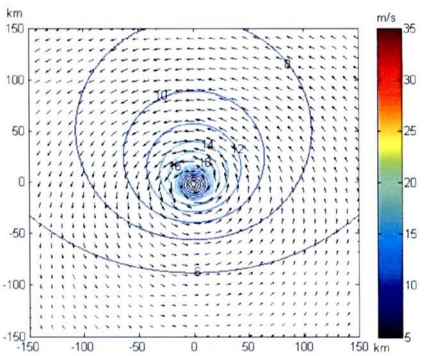
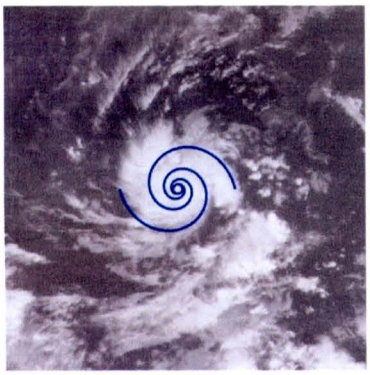


27/12/2001 at 1200UTC

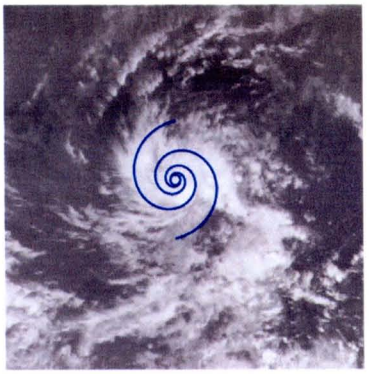
Figure 4.6 Wind speed and wind vector for Vamei from the asymmetric wind model.

4.5 Value of the Wind Ratio *m*

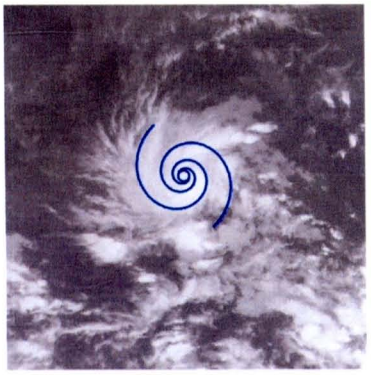
The appropriate values of the wind ratio *m* for typhoon Gay during 02-04 November 1989 are shown in Figure 4.7, with the corresponding satellite images. Figure 4.8 shows the appropriate values of *m* for typhoon Vamei at 0000UTC, 27 December 2001.



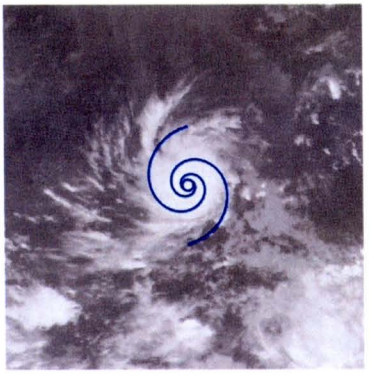
02/11/1989 at 0300UTC, *m* = -0.20



02/11/1989 at 0600UTC, *m* = -0.21

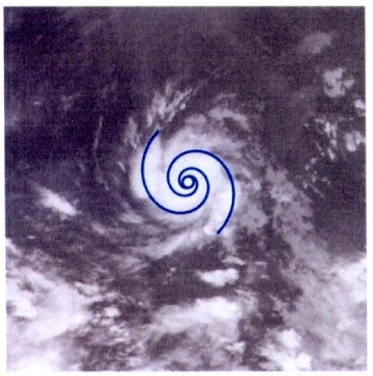


02/11/1989 at 1200UTC, *m* = -0.21



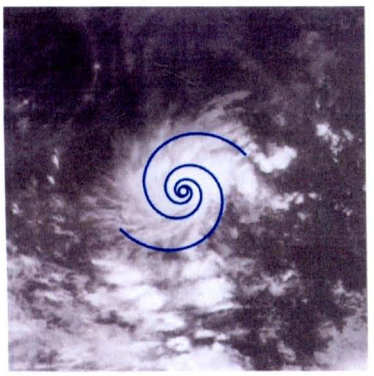
02/11/1989 at 1800UTC, *m* = -0.21

Figure 4.7 Spiral patterns and satellite images of typhoon Gay during 02 November 1989, 0300UTC to 04 November 1989, 1200UTC.

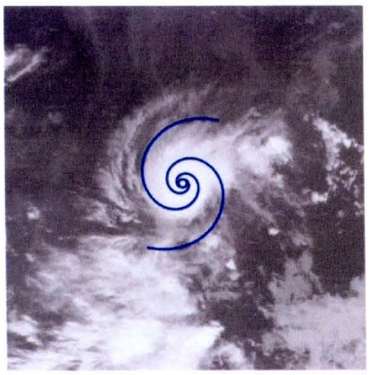


03/11/1989 at 0000UTC, m = -0.22

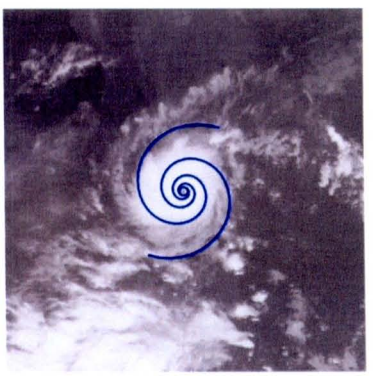
03/11/1989 at 0600UTC, m = -0.23



03/11/1989 at 1200UTC, m = -0.23



03/11/1989 at 1800UTC, m = -0.21



4/11/1989 at 0000UTC, m = -0.21

04/11/1989 at 0600UTC, m = -0.24

Figure 4.7 Spiral patterns and satellite images of typhoon Gay during 02 November 1989, 0300UTC to 04 November 1989, 1200UTC (continued).

04/11/1989 at 1200UTC, m = -0.23

Figure 4.7 Spiral patterns and satellite images of typhoon Gay during 02 November 1989, 0300UTC to 04 November 1989, 1200UTC (continued).

27/12/2001 at 0000UTC, m = -0.20

27/12/2001 at 0600UTC, m = -0.21

27/12/2001 at 1200UTC, m = -0.20

Figure 4.8 Spiral patterns and satellite images of typhoon Vamei on 27 December 2001, 0000-1200UTC.

The radial wind speed is calculated from Equation (2.9) using the appropriate value of m. The radial wind speeds are shown Tables 4.3-4.4. The relative error is defined as

$$Relative\ error = \frac{Calculated\ Radial\ Wind - Observed\ Radial\ Wind}{Observed\ Radial\ Wind}$$

Table 4.3 Calculated radial wind speed of Gay

No	Date/Time	m	Radius of Maximum Wind (km)	Radius of Tropical Cyclone (km)	Observed Tangential Wind (m/s)	Calculated Radial Wind (m/s)	Observed Radial Wind (m/s)	Relative Error
1	2/11/1989/03	-0.20	18.5	111.1	17.5	3.5	6.2	-0.4
2	2/11/1989/06	-0.21	18.5	111.1	20.0	4.2	7.3	-0.4
3	2/11/1989/12	-0.21	18.5	111.1	20.0	4.2	6.8	-0.3
4	2/11/1989/18	-0.21	18.5	111.1	22.5	4.7	7.5	-0.3
5	3/11/1989/00	-0.22	27.7	111.1	22.5	4.9	8.0	-0.3
6	3/11/1989/06	-0.23	27.7	148.2	27.5	6.3	7.5	-0.1
7	3/11/1989/12	-0.23	37.0	185.2	30.0	6.9	6.2	0.1
8	3/11/1989/18	-0.21	37.0	185.2	32.5	6.8	7.5	-0.1
9	4/11/1989/00	-0.21	37.0	185.2	37.5	7.8	7.0	0.1
10	4/11/1989/06	-0.24	37.0	185.2	32.5	7.8	7.3	0.1
11	4/11/1989/12	-0.23	37.0	185.2	30.0	6.9	6.2	0.1

Table 4.4 Calculated radial wind speed of Vamei.

No	Date/Time	m	Radius of Maximum Wind (km)	Radius of Tropical Cyclone (km)	Observed Tangential Wind (m/s)	Calculated Radial Wind (m/s)	Observed Radial Wind (m/s)	Relative Error
1	27/12/2001/00	-0.20	37.0	185.2	20.0	4.0	7.4	-0.4
2	27/12/2001/06	-0.21	46.3	222.2	22.5	4.7	8.3	-0.4
3	27/12/2001/12	-0.20	37.0	185.2	17.5	3.5	7.2	-0.5

From Tables 4.3 and 4.4, the calculated radial winds are too low when compared with observed winds. Note that for a tropical cyclone to form, the observed radial wind must be more than 6 m/s. This radial wind is correspond to the northeast monsoon with prevails over the Gulf of Thailand during winter.

4.6 Spiral Pattern and Asymmetric Wind Vector

The various values of $\Delta\theta$ for Gay computed from Equation (2.11) are shown in Table 4.5. These values of $\Delta\theta$ are used to find a linear regression equation for $\Delta\theta$ in terms of the distance from the storm center (r).

The equation is found to be

$$\Delta\theta = 6.342 + (0.135r) \tag{4.1}$$

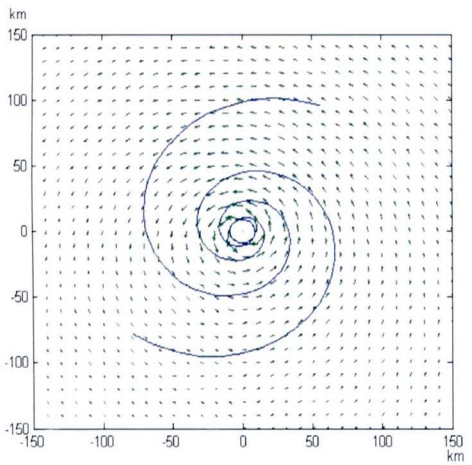
where r is the distance from storm center in km.

Table 4.5 Distance and $\Delta\theta$ for Gay

r	$\Delta\theta$
111	13
103.5	12
96.6	13
90.2	14
84.1	17
78.5	16
73.3	13
68.4	11
63.8	14
59.5	12
55.6	13
51.8	10
48.4	10
45.1	14
42.1	14
39.3	16
36.7	13
34.2	13
31.9	13
29.8	12
27.8	15
26.0	17
24.2	14
22.6	13
21.1	12
19.7	12
18.4	12

Table 4.5 shows the various values of distance r and corresponding $\Delta\theta$ for Gay obtained from Equation (4.1).

The spiral patterns obtained from Equation (4.1) are overlaid wind vectors of spiral flow from Equation (2.17) to verify the regression equation. The results are shown in Figures 4.9-4.10.



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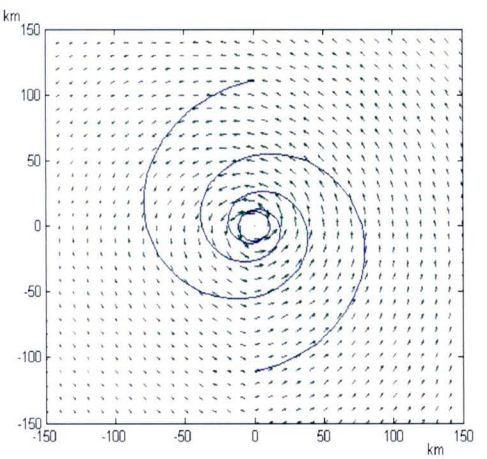

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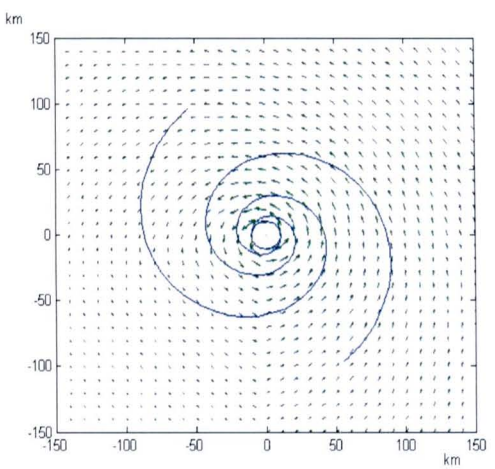

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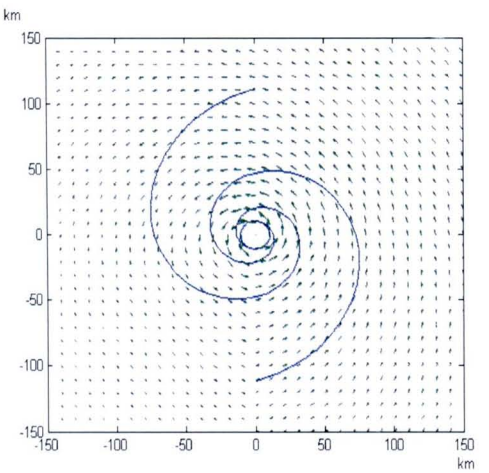

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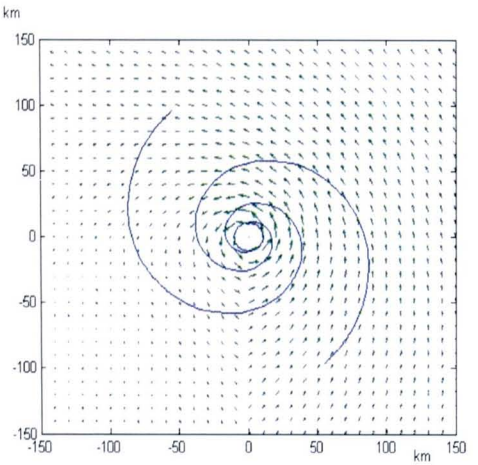
Figure 4.9 Spiral pattern from Equation (4.1) and corresponding wind vector from Equation (2.17) for Gay.



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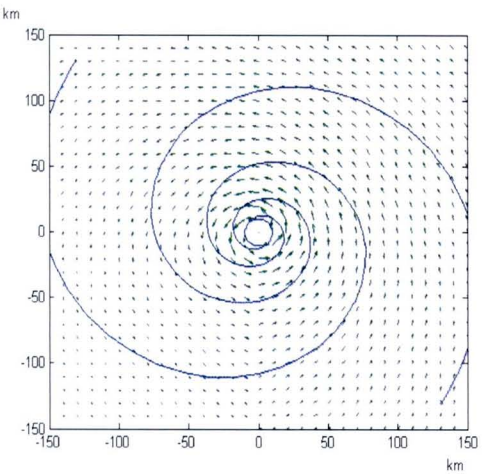

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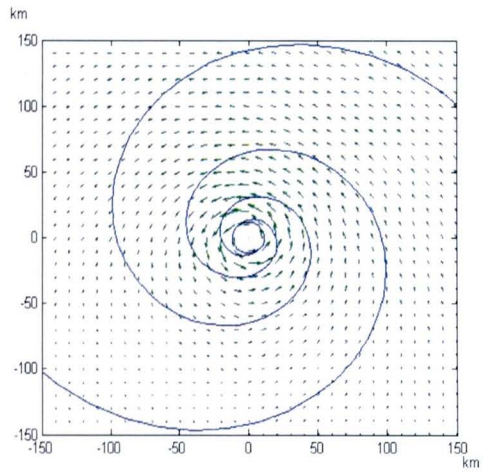

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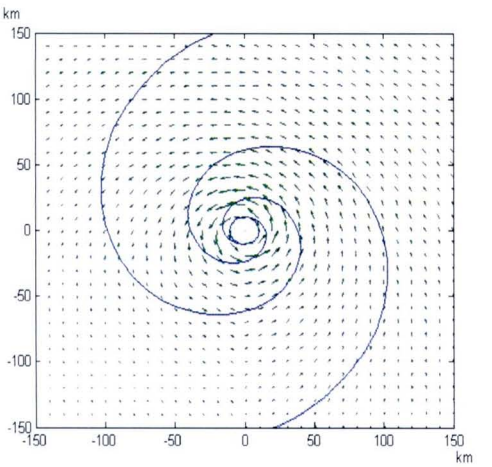
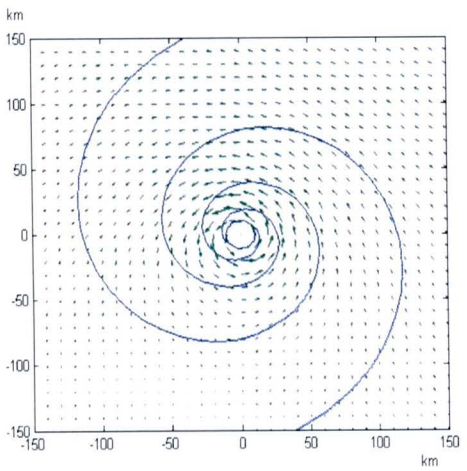


03/11/1989 at 1800UTC

Figure 4.9 Spiral pattern from Equation (4.1) and corresponding wind vector from Equation (2.17) for Gay (continued).



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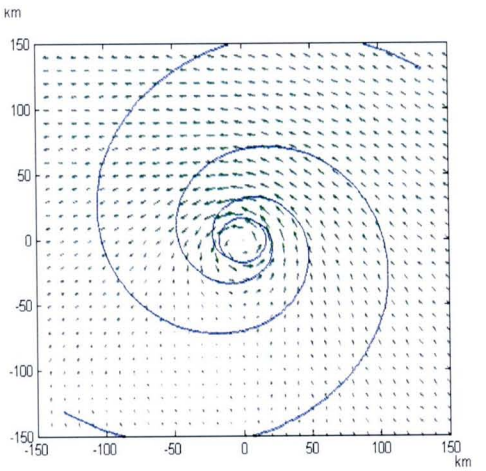

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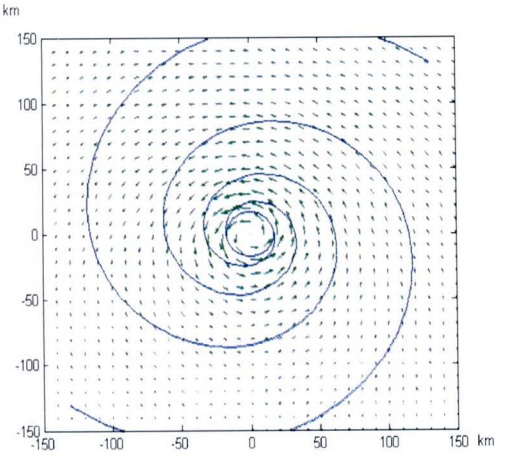
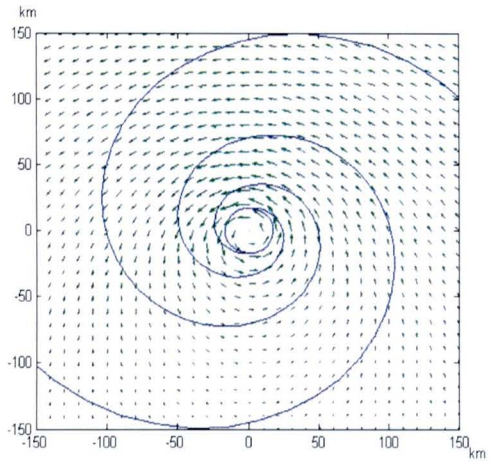


04/11/1989 at 1200UTC

Figure 4.9 Spiral pattern from Equation (4.1) and corresponding wind vector from Equation (2.17) for Gay (continued).



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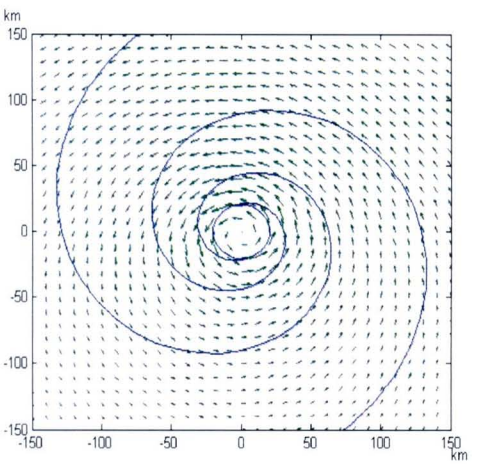

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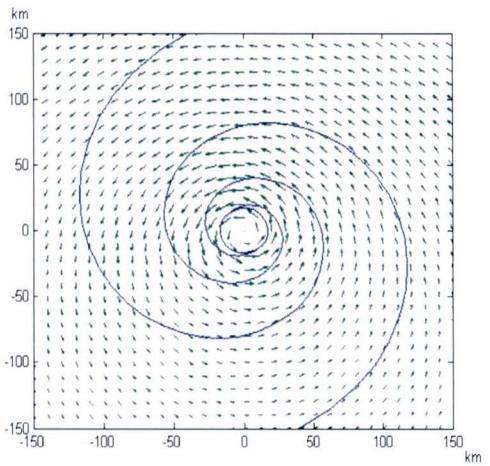

27/12/2001 at 1200UTC

Figure 4.10 Spiral pattern from Equation (4.1) and corresponding wind vector from Equation (2.17) for Vamei.

From Figure 4.9-4.10, it appears that the regression equation provides good results for both Gay and Vamei.