Meteorological Measurements of Mangalore Region for ARMEX Programme: Observations and Data Analysis

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1. Introduction

This presentation presents the meteorological parameters documented using a micrometeorological tower (20 m) located at Mangalore University Campus, (12°49’00’’N latitude and 74°56’23”E longitude; elevation: 80 m amsl) located 8 km south of Mangalore City during the ARMEX period from June to August of 2002 and 2003.

2. Aim and Objectives

Observations of humidity, temperature, solar radiation, barometric pressure, rainfall, wind speed and wind directions were recorded by the sensors incorporated in the tower during the Arabian Sea Monsoon Experiment (ARMEX).

3. Experimental details

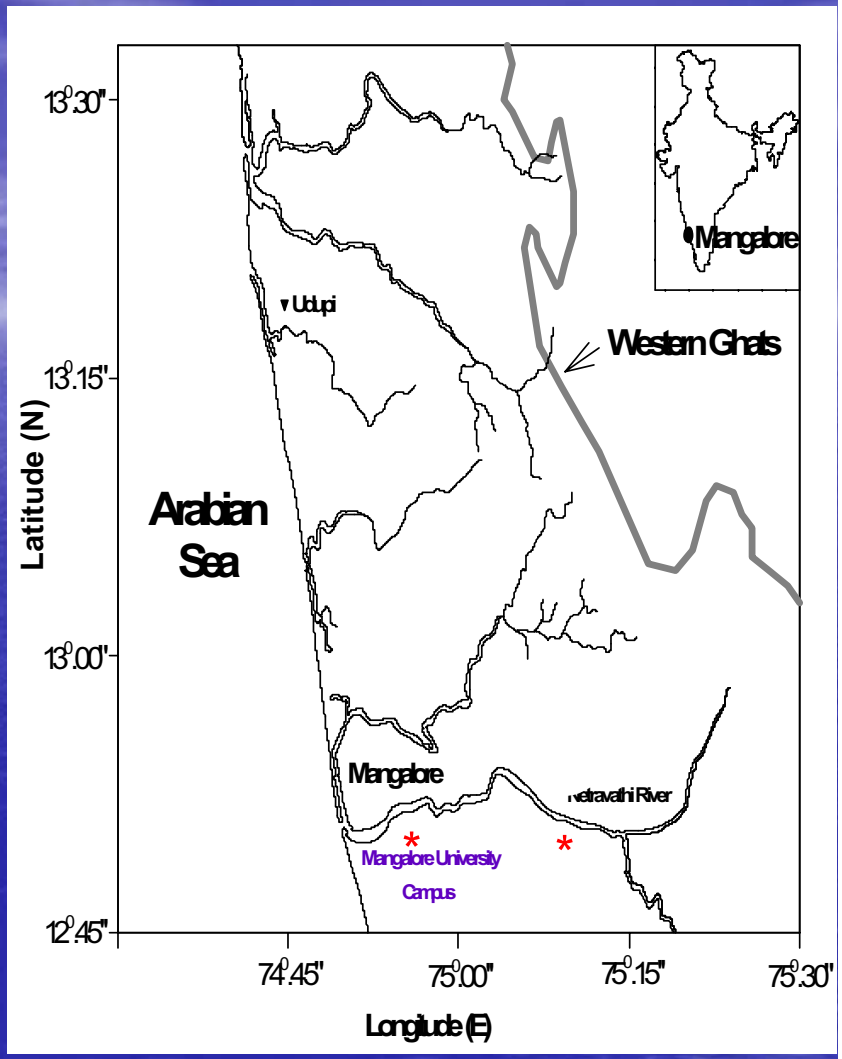
a) **Locations:**

Mangalore University Camus, ~5 kms aerial distance from the coast.

b) **Instruments:** Sensors from NRG systems USA.

c) **Parameters measured:** Humidity, temperature, solar radiation, barometric pressure, rainfall, wind speed and wind directions.

d) **Data base**: June, July and August of the year 2003 and 2004.



4. Sensor Details

Meteorological parameters	Sensors	*Model NRG Type*
Wind speed	Anemometer	*Maximum # 40*
Wind direction	Wind vane	*200P*
Solar radiation	Li-Cor pyranometer	*LI-200SA*
Temperature	Temperature sensor	*110S*
Barometric pressure	Pressure sensor	*BP-20*
Relative humidity	Humidity sensor	*RH-5V*
Rainfall	Tipping bucket rain gauge	260-2501

5. Results

Wind profile in the surface layer

June, 2002

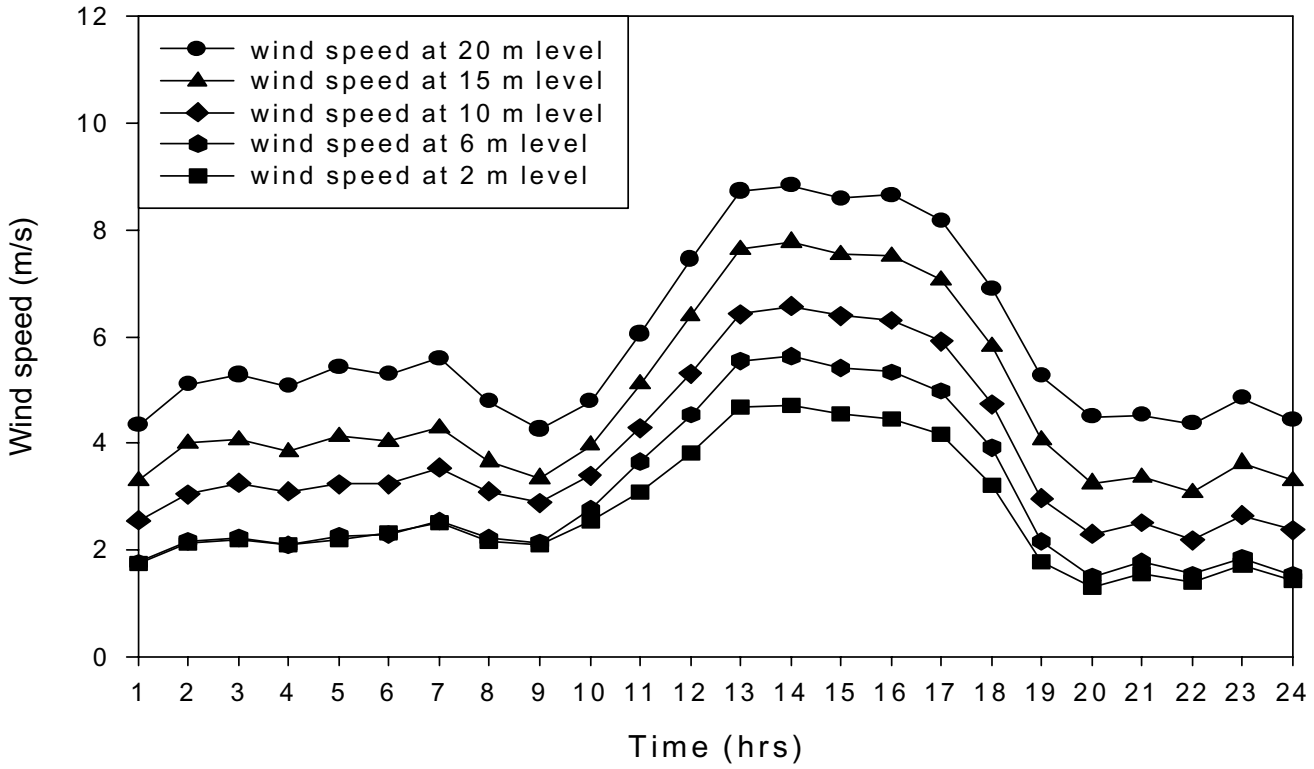


Fig. 2 Diurnal variation of wind speed at different levels

July 2002

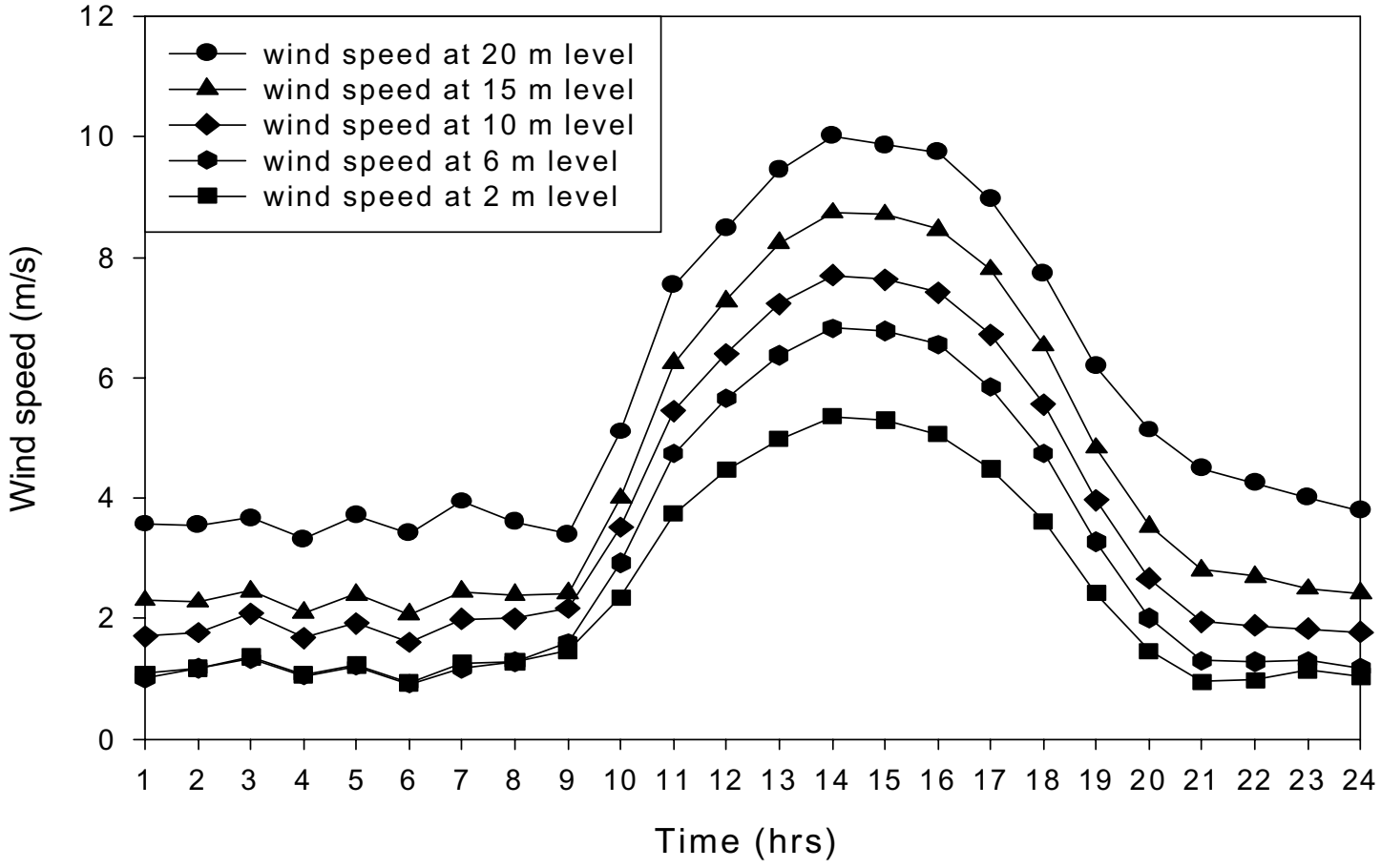


Fig. 3 Diurnal variation of wind speed at different levels

August 2002

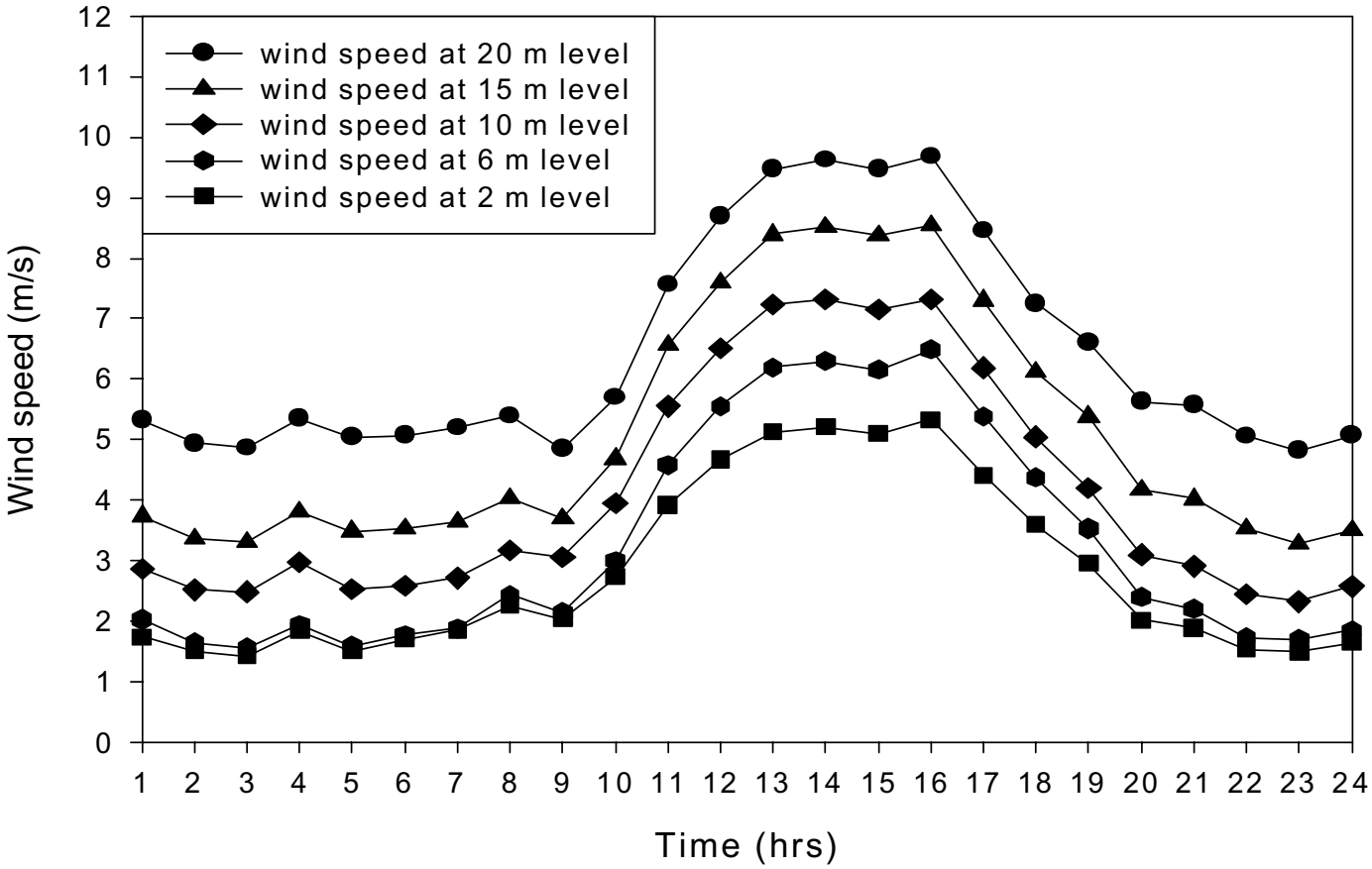


Fig. 4 Diurnal variation of wind speed at different levels

June 2003

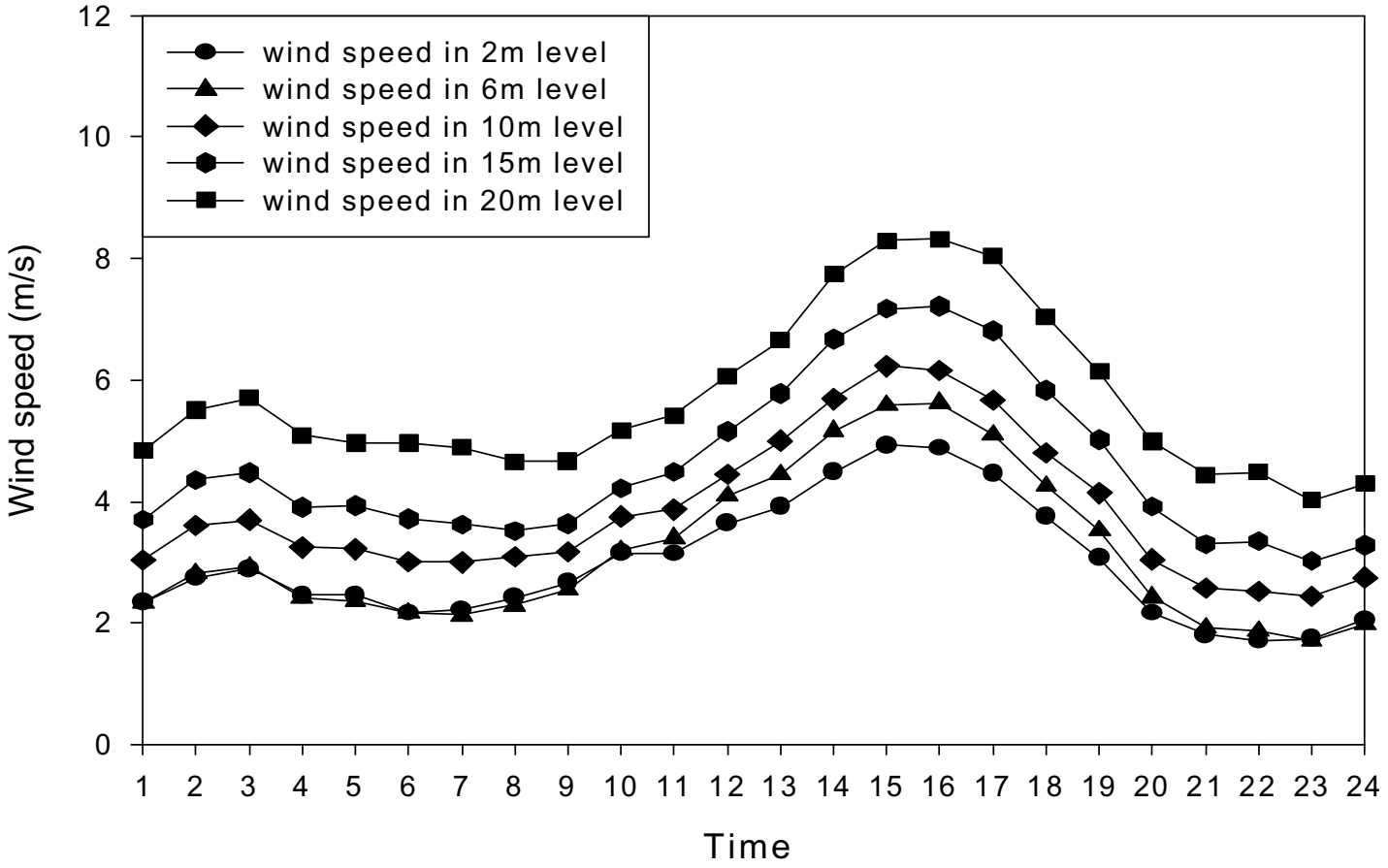


Fig. 5: Diurnal variation of wind speed in different levels.

July 2003

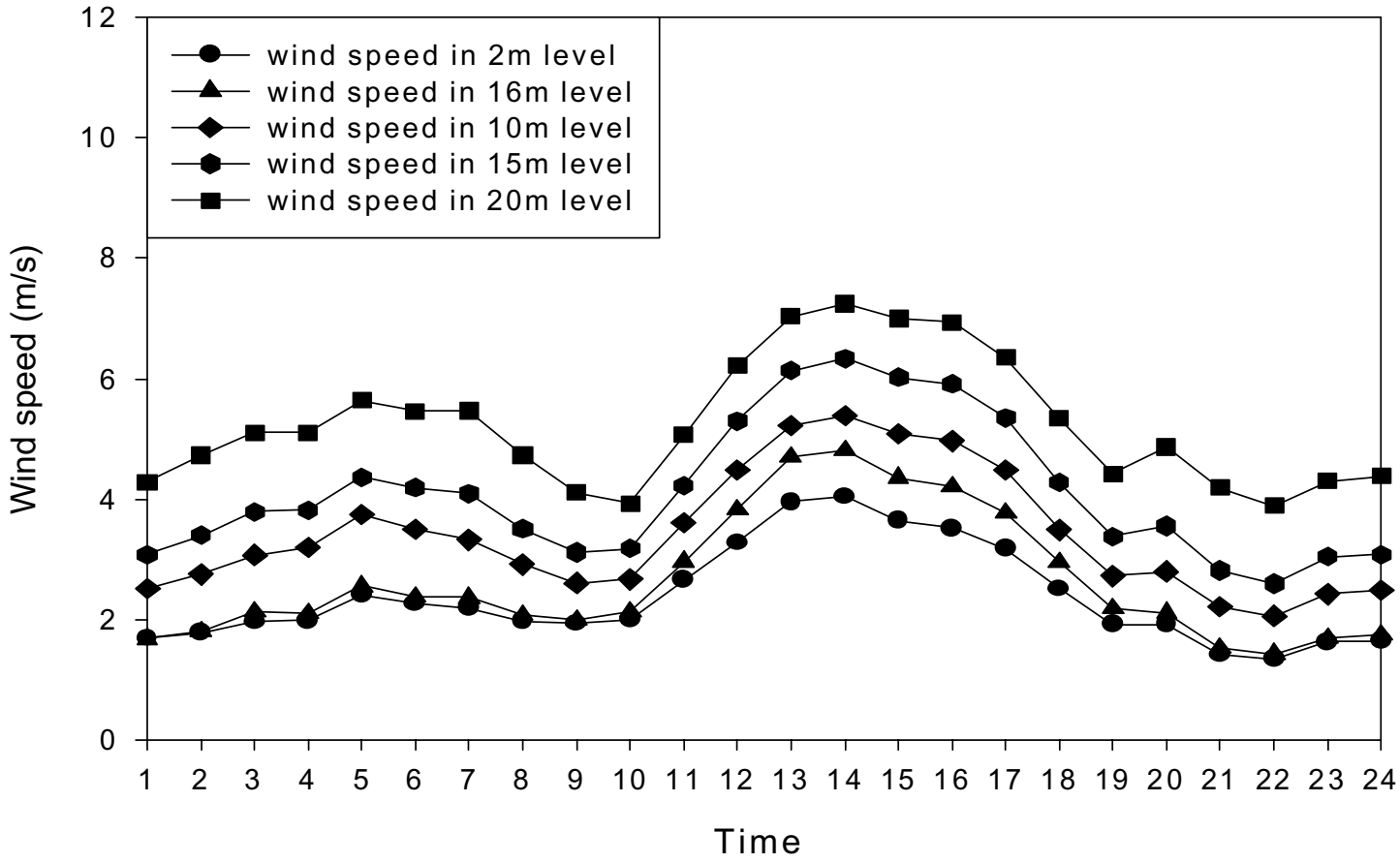


Fig. 6: Diurnal variation of wind speed in different levels.

August 2003

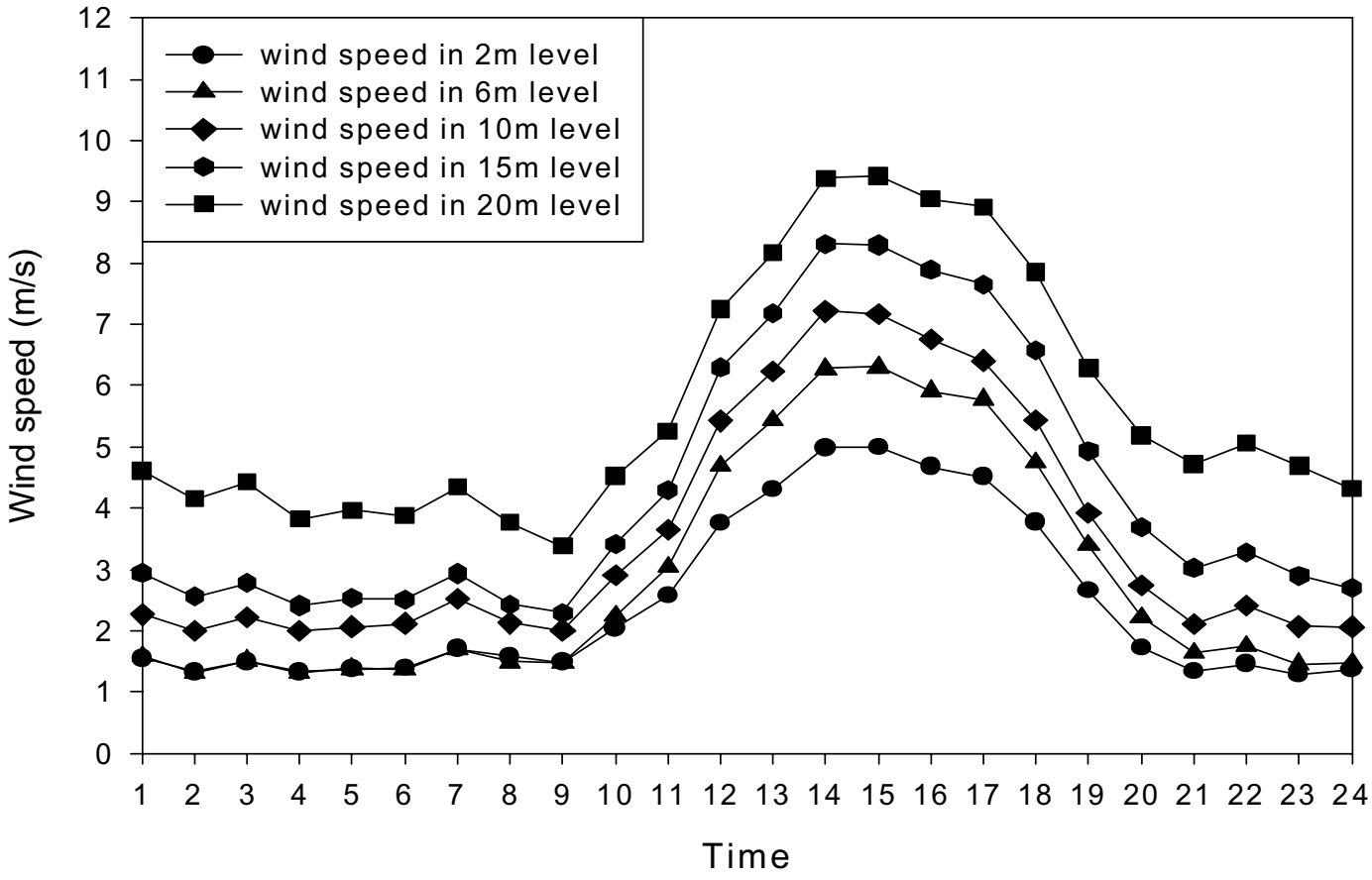


Fig. 7: Diurnal variation of wind speed in different levels.

Rainfall during ARMEX period 2002

Month	***Rain fall in mm***
June	*751.3*
July	*536.5*
August	*533.2*
Total	***1821***

Rainfall during ARMEX period 2003

Month / Year	***Rain fall in mm***
June	*1408.42*
July	*1095.77*
August	*629.15*
Total	***3133.34***

Heavy Rainfall events

The following were associated with heavy rainfall events (rainfall more than 100 mm/day) during ARMEX period 2002 and 2003 at Mangalore University Campus,

- July 11th 2002 (~158 mm)
- June 21st 2003 (~220 mm)
- June 22nd 2003 (~221 mm)
- July 15th 2003 (~103 mm)

Maximum and Minimum temperatures (°C). 2002

Month	*Max*	*Min*
June	30.4	22.6
July	29.5	22.4
August	29.2	21.9

Maximum and Minimum temperatures (ºC). 2003

Month	*Max*	*Min*
June	31.9	21.3
July	29	21.6
August	28.9	21.6

Pressure variation during 2002

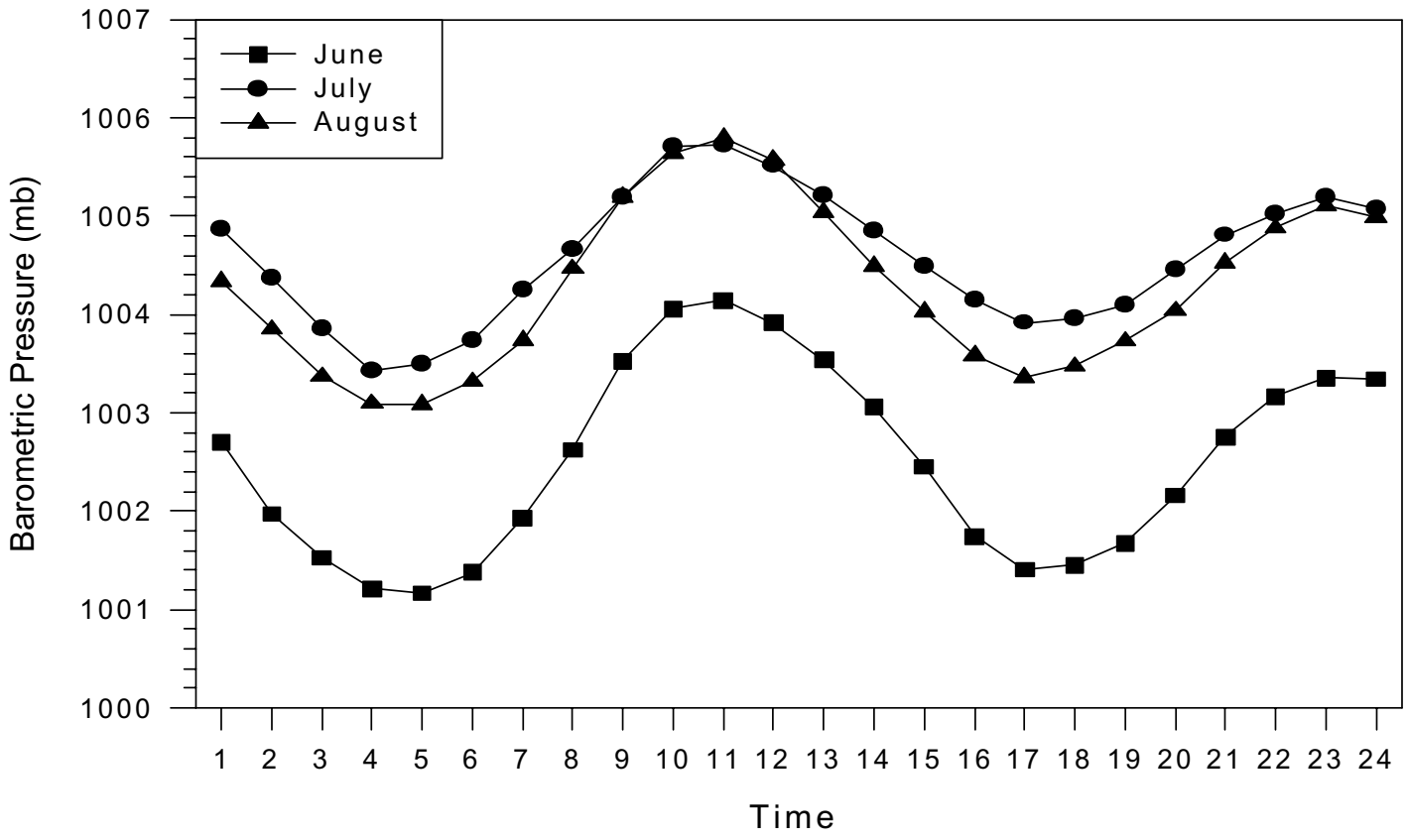


Fig.19. Diurnal variation of pressure during ARMEX period.

Pressure variation during 2003

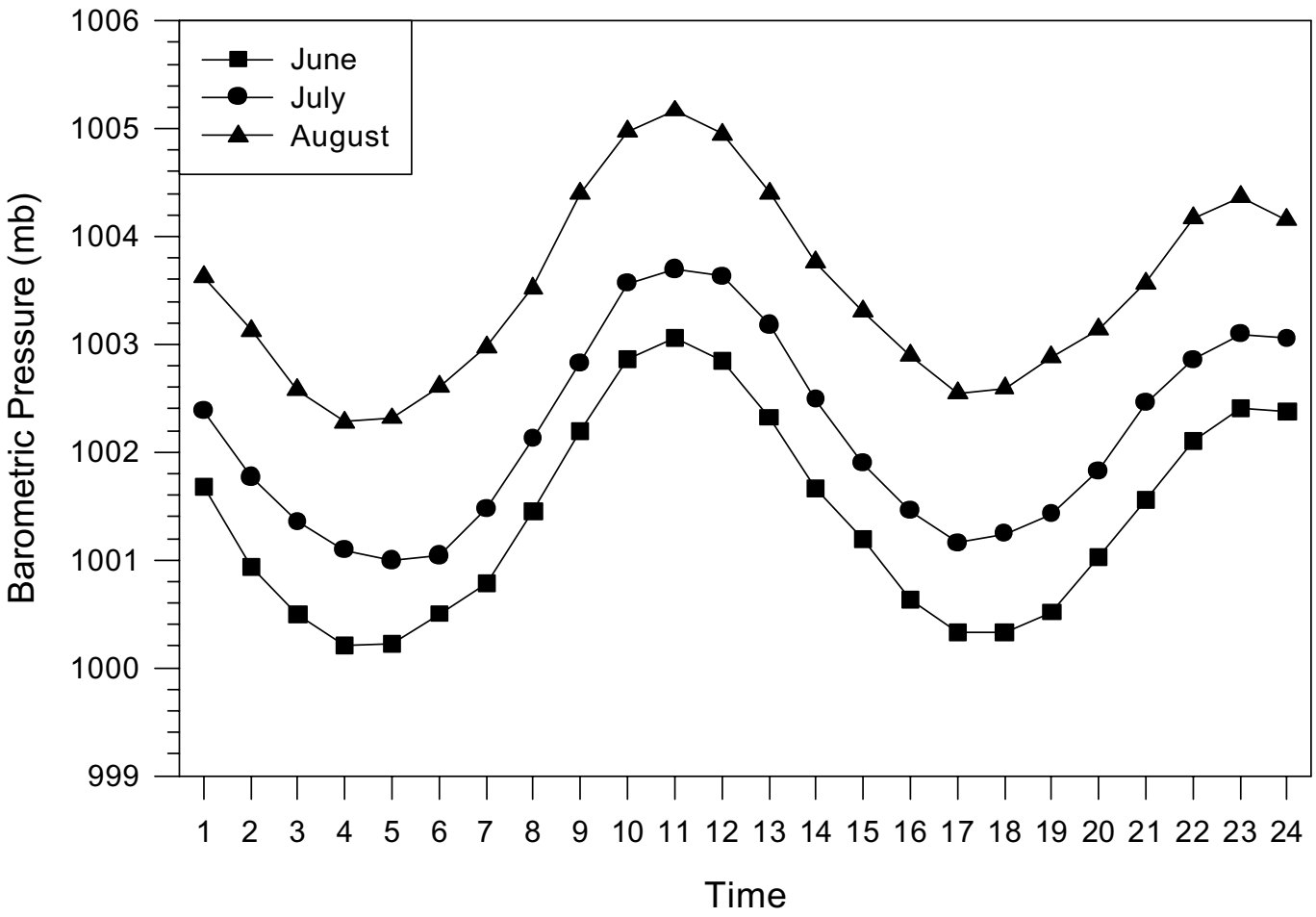


Fig.20. Diurnal variation of pressure during ARMEX period.

Solar Radiation during 2002

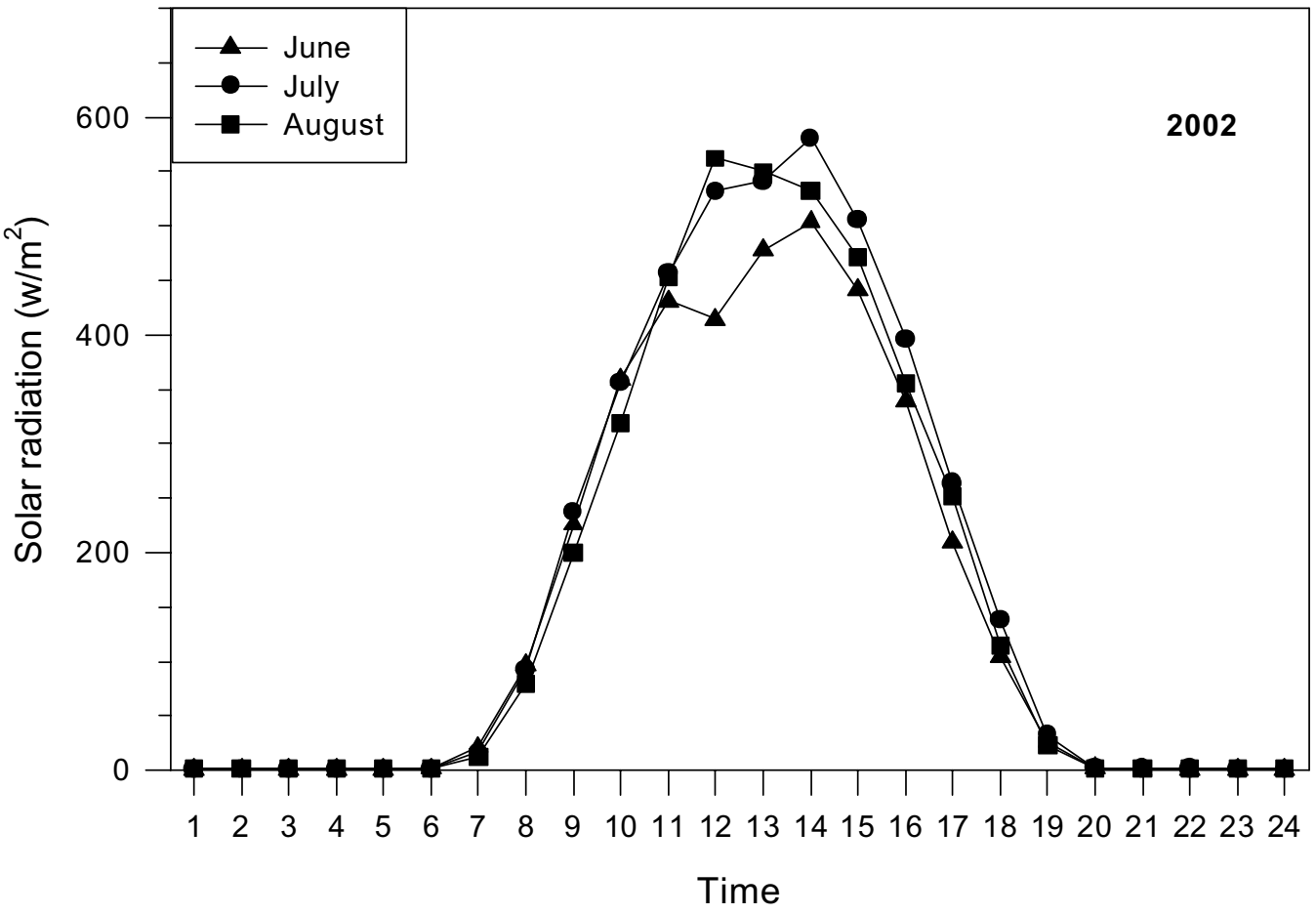


Fig. 21. Diurnal variation of solar radiation during ARMEX period.

Solar Radiation during 2003

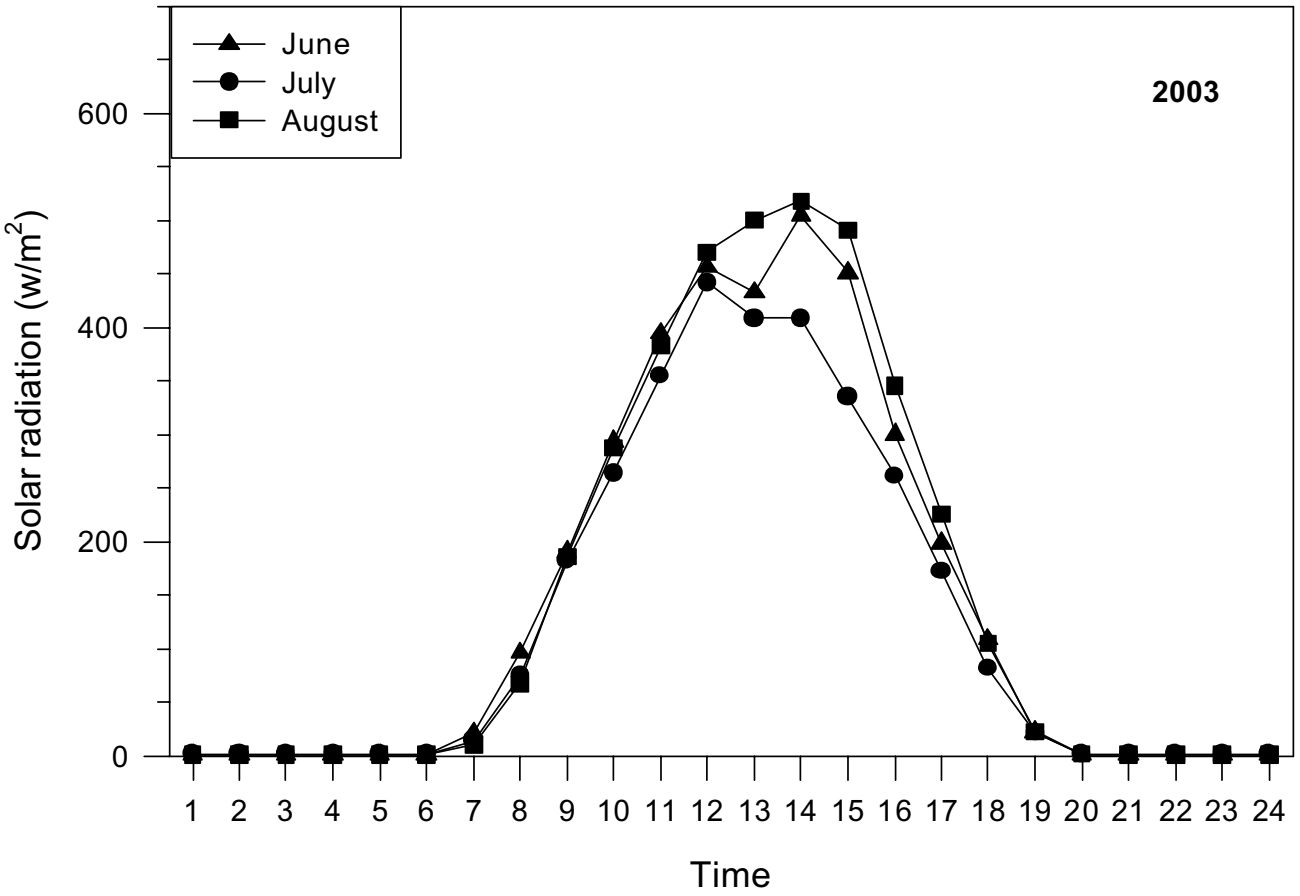
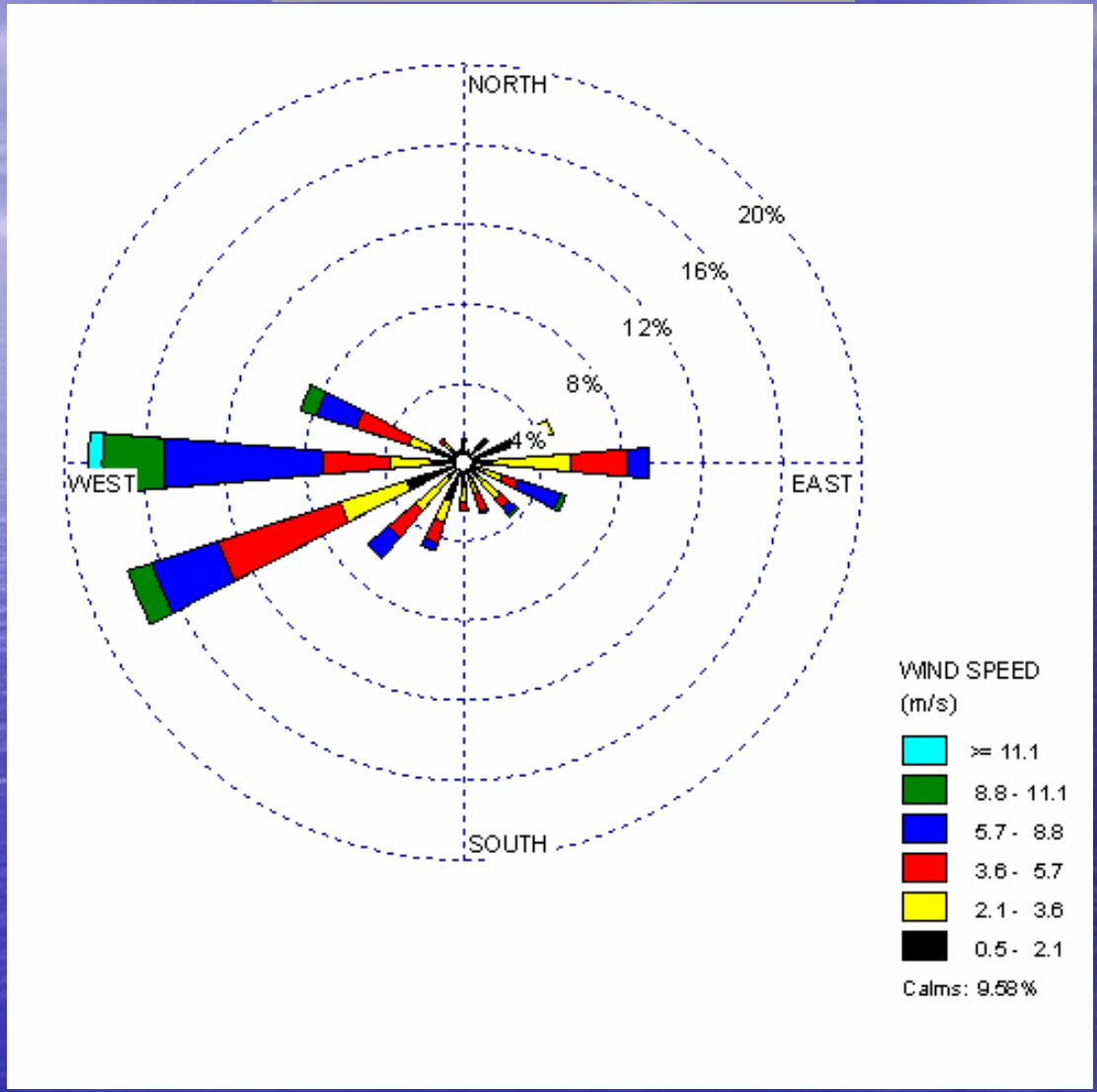
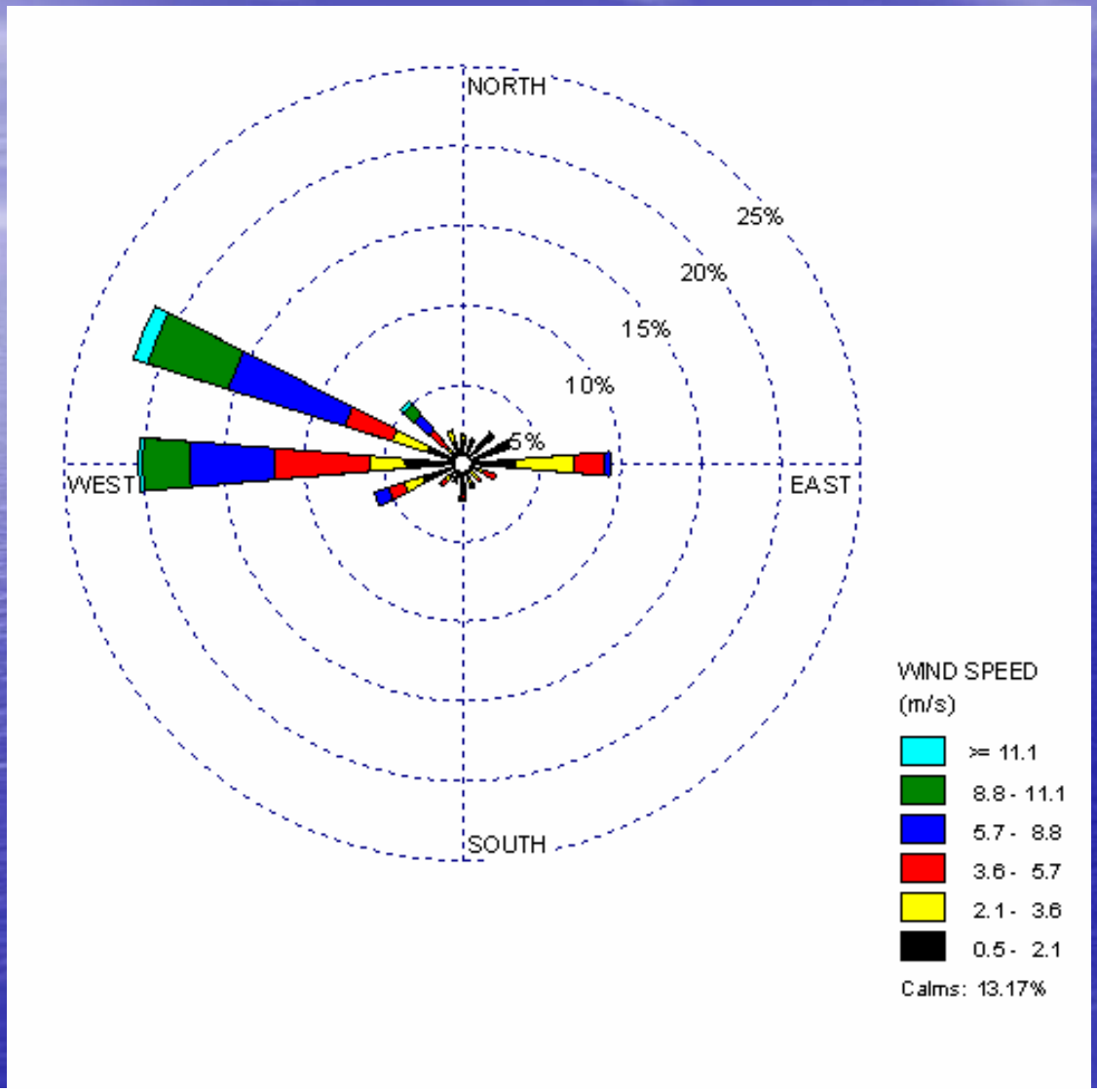


Fig. 22. Diurnal variation of solar radiation during ARMEX period.

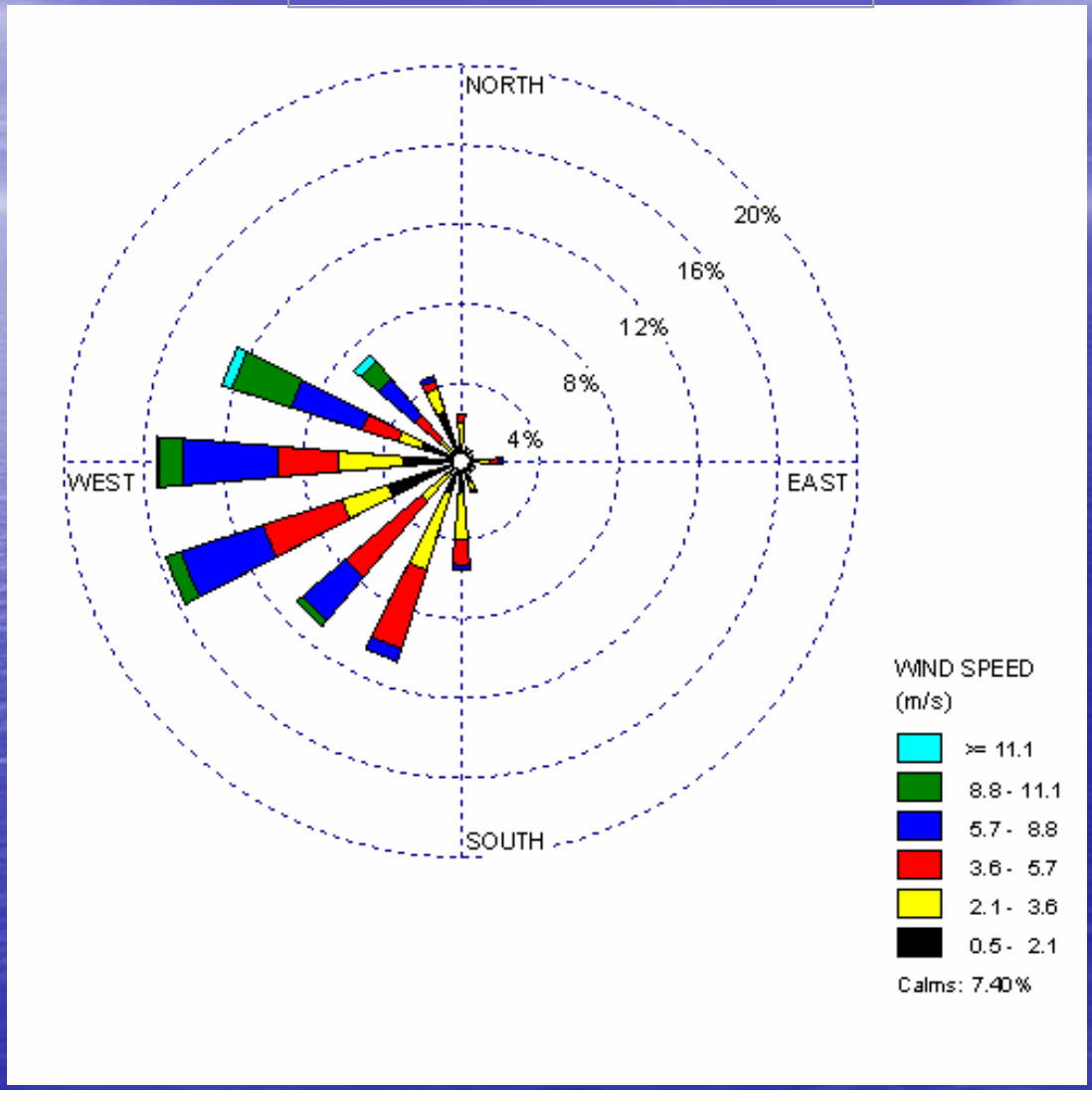
June 2002


NORTH
20%
16%
12%
8%
4%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 11.1
8.8 - 11.1
5.7 - 8.8
3.6 - 5.7
2.1 - 3.6
0.5 - 2.1
Calms: 9.58%

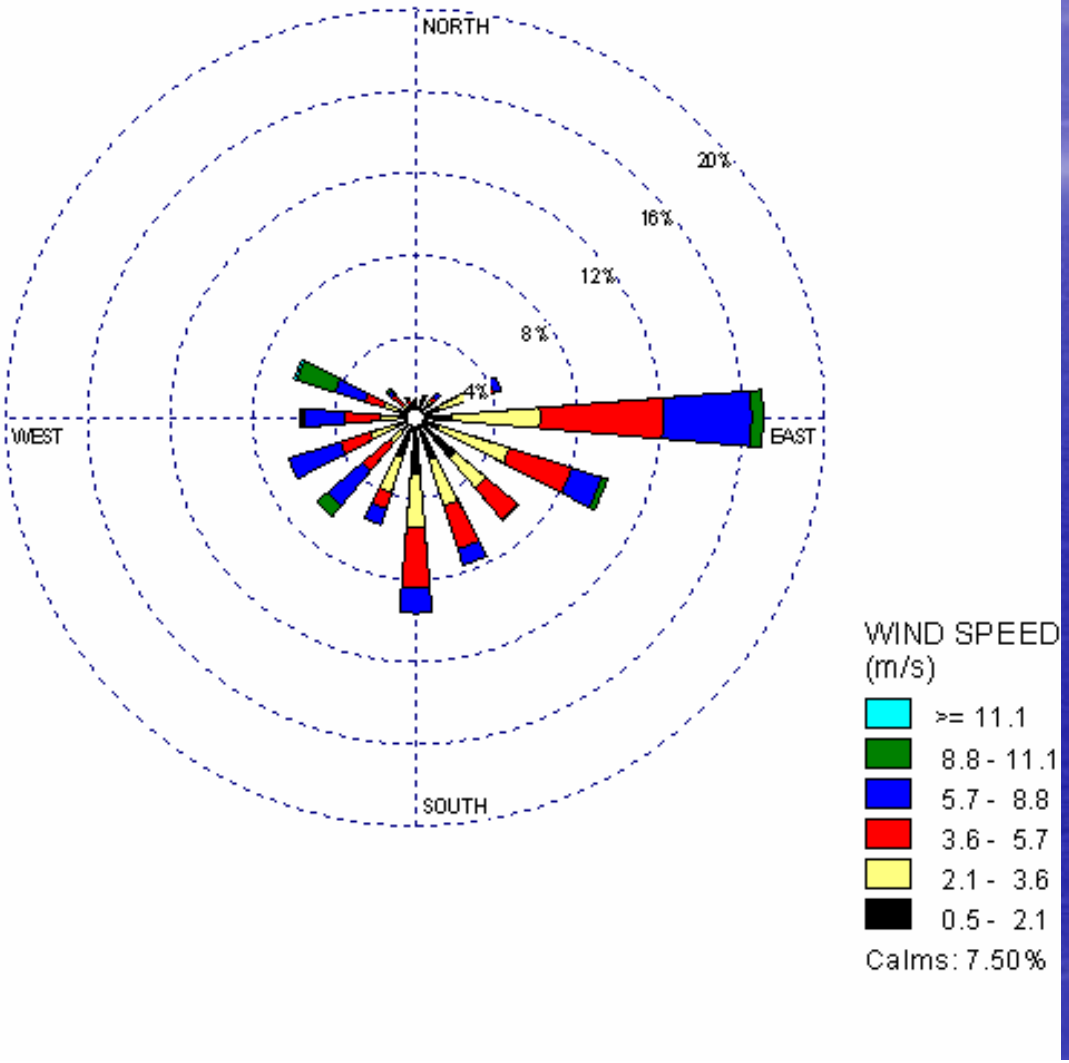
July 2002


NORTH
25%
20%
15%
10%
5%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 11.1
8.8 - 11.1
5.7 - 8.8
3.6 - 5.7
2.1 - 3.6
0.5 - 2.1
Calms: 13.17%

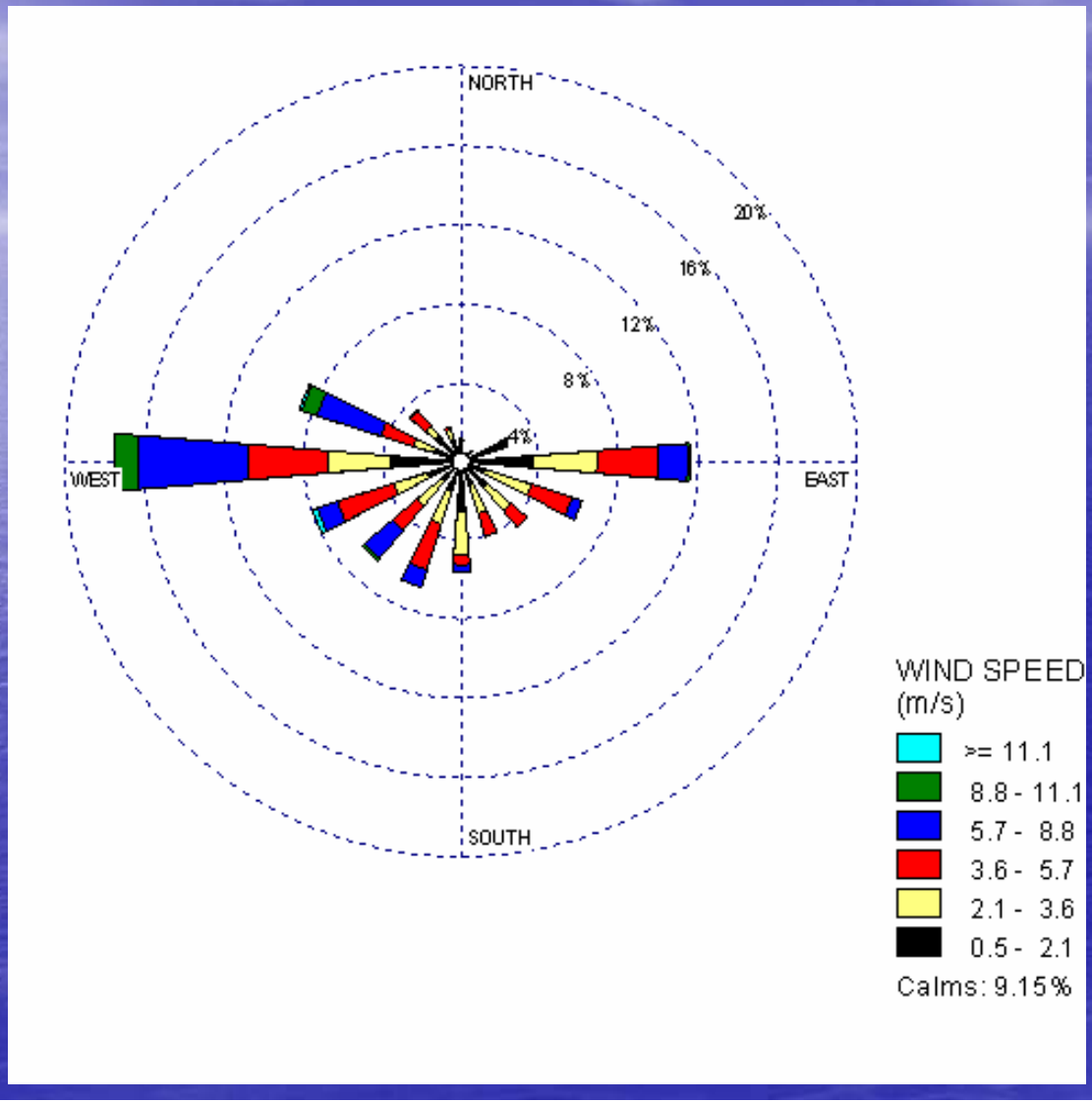
August 2002


NORTH
20%
16%
12%
8%
4%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 11.1
8.8 - 11.1
5.7 - 8.8
3.6 - 5.7
2.1 - 3.6
0.5 - 2.1
Calms: 7.40%

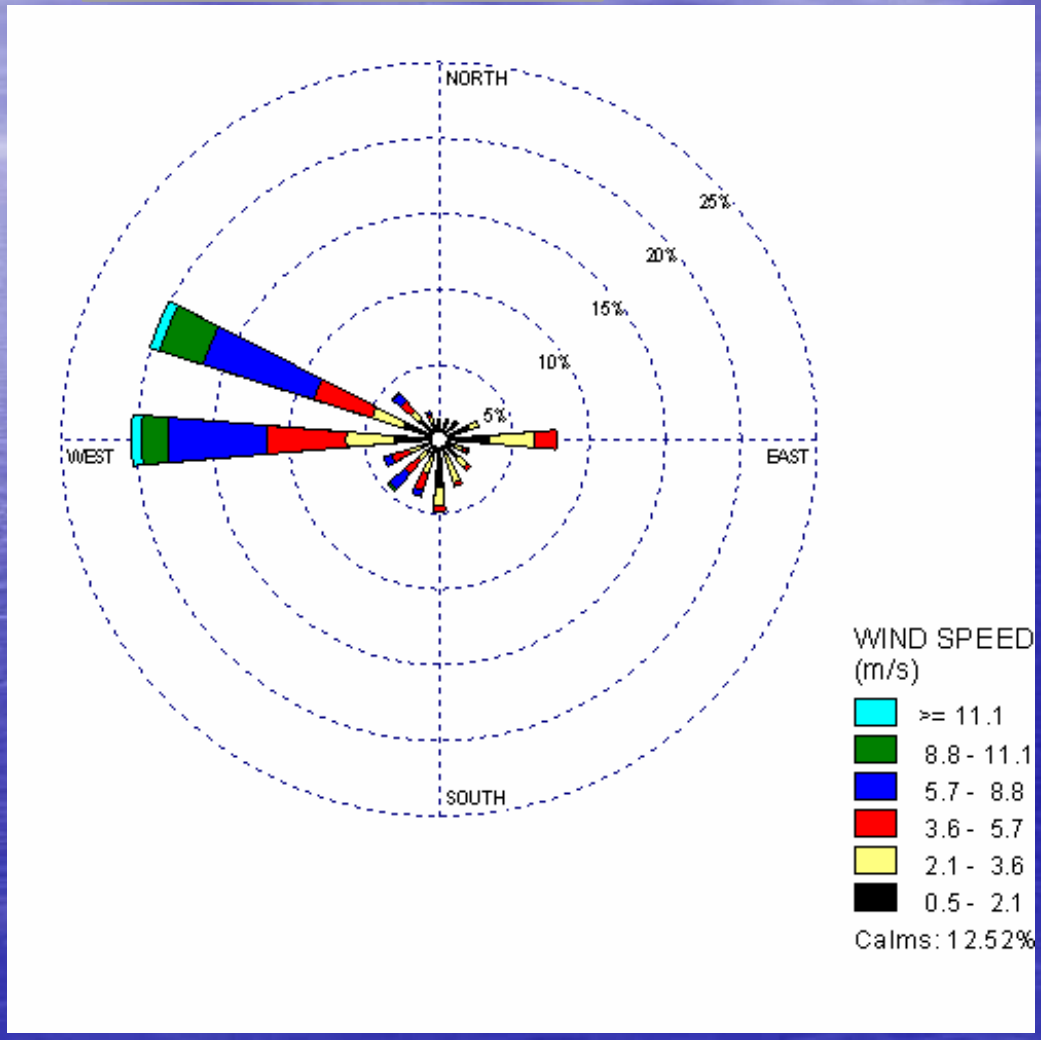
June 2003


NORTH
EAST
SOUTH
WEST
4%
8%
12%
16%
20%
WIND SPEED
(m/s)
>= 11.1
8.8 - 11.1
5.7 - 8.8
3.6 - 5.7
2.1 - 3.6
0.5 - 2.1
Calms: 7.50%

July 2003


NORTH
20%
16%
12%
8%
4%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 11.1
8.8 - 11.1
5.7 - 8.8
3.6 - 5.7
2.1 - 3.6
0.5 - 2.1
Calms: 9.15%

August 2003


NORTH
25%
20%
15%
10%
5%
WEST
EAST
SOUTH
WIND SPEED
(m/s)
>= 11.1
8.8 - 11.1
5.7 - 8.8
3.6 - 5.7
2.1 - 3.6
0.5 - 2.1
Calms: 12.52%

Conclusion

From the preliminary analysis of the data the following conclusions are drawn.

- The experiment has provided some good data set for studies on wind profile from surface level up to 20 m height at a coastal location (Mangalore University Campus).
- Study of wind profiles showed that moderate to gusty winds occur during day time and gentle winds at night (Figs. 2, 3 and 4).
- Winds were W-SW in June, July and August showing land breeze at the site during mornings and southerly after the onset of sea breeze around noon / afternoon.
- Rainfall in the year 2002 was weak over study the area.

Acknowlegdement

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We remember Late B Raghuchandra, Research Scholar for his initial work. We thank Dr. B D Acharya, Dr. P Sanjeeva Rao, DST, New Delhi; Dr. Sivaramakrishnan, IITM, Pune; Dr. R Venkatesan, Kalpakkam; Prof. R Shankar, Mangalore University for their valuable suggestions, guidance and help during the project work.


THANK YOU