CHAPTER VI

CONCLUSIONS AND
FUTURE SCOPE OF THE STUDY
6.1 Conclusions

An L-band (1357.5 MHz) lower atmospheric wind profiler (LAWP) has been operating continuously since 15 September 1997 at Gadanki, India. LAWP produced quality data until September 2000. In India, the only one LAWP at Gadanki operated for 3 years and above. Still, India, several UHF/L-band wind profilers under progress and only one more wind profiler is operational at Indian Institute of Tropical Meterology (IITM), Pune. Though the date is relative old, however, we utilized extensively to understand some of the lower atmospheric phenomenon such as low level jet and tropospheric ducts in details.

Over Gadanki, in the entire observational period, 80% availability of the LAWP was determined with 3.6-km wind measurements in low mode and 5-km wind measurements in high mode. It was observed that the Gadanki-LAWP, given its sensitivity to irregularities in the moisture field, is a useful tool in monitoring the wind profiles of approaching precipitating cloud systems and tropical cyclones. It had been illustrated that the wind profiler was able to detect and characteristic mesoscale phenomena in the lower troposphere, which are unresolved temporally and vertically by the synoptic-scale radiosonde network.

Observations on clear air (i.e. precipitation free) days are used to study diurnal evolution and seasonal variations of atmospheric boundary layer. These observations are also utilized to study some of the dynamical
features of boundary layer such as Low Level Jet (LLJ), Tropical ducts within the boundary layer.

The monsoon precipitation at Gadanki the vertical structure of precipitating cloud systems has been examined by using LAWP vertical beam data. It has been confirmed that during the occurrence of stratiform cloud, radar bright band is observed by the LAWP as an increase of radar reflectivity below the melting level. During the occurrence of convective cloud, intense reflectivity is detected at the whole sampling height range. Diurnal variations of the occurrence of precipitating cloud systems over Gadanki showed that the precipitation occurring in the afternoon and the peak of the stratiform cloud comes after the peak of the convective cloud. The precipitating cloud systems, which occur in the early morning, are dominated by stratiform cloud. Concerning seasonal variations of the precipitating clouds, we have found that the occurrence of the stratiform precipitating cloud systems is more frequent in the NE monsoon, while the occurrence of the convective precipitating cloud systems is predominant in SW monsoon. Moreover, in the NE monsoon, a higher occurrence of precipitating cloud systems was observed.

The boundary layer winds during monsoon season shows LLJ features at 1.2 km with average wind speeds ~ 20 m/s. It is observed that, during active monsoon period, strong LLJ persists for a few days and shows clear diurnal evolution with varying LLJ core height in the range of 1.2±0.6 km and varying wind speeds in the rage of 15-20 m m/s. The
maximum observed LLJ speed is \(~ 22\) m/s. From the routine radisonde observations of wind speed at 850 hPA shows gradually decrease in intensity and strength of the LLJ from India to Bangkok.

We made an attempt on ducts using wind profiler observations along with radiosonde observations. This study reveals that the refractivity is generally high during the rainy reason (June-September) at all the levels. During the months of March and May, when the dry moist wind was intense, the values of observed refractivity fall sharply. Propagation conditions have varying degree of occurrence with sub-refractive conditions prevalent at all the levels from the month of January to May, super refractive conditions are prevalent at 150m and 200m levels from June to December and ducting conditions are observed at 50 m, 100m and 150m from August to December. The results obtained show that the propagation conditions have varying degree of occurrence with sub-refractive conditions observed to be prevalent between January–July while Super-refraction and Ducting were observed mostly between August–December.

6.2 Future Scope of the Study

LAWP is unable to probe the first few hundred meter of the atmosphere, i.e. 500 m, from the Earth's surface. In lower height region which plays a vital role on the structure and dynamics of boundary layer. So, it is important to probe this region using

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SODAR and tower with fast responding sensors, together with LAWP observations for better understanding the boundary layer structure, turbulent fluxes and convective plumes characteristics. This is particularly important for the studies of nocturnal boundary layer and boundary layer related wave studies such as mountain waves.

It is observed that during monsoon season, like LLJ, there exists Tropical Easterly Jet (TEJ) near tropopause height (~ 16 km). The relation between LLJ and TEJ can be studied as a coupled entity to understand the wind systems during monsoon season.

The occurrence of occasional peculiar high reflectivity in LAWP observations during nocturnal time, i.e., sunset to sunrise, can be examined in detail to identify the source mechanism associated with such peculiar echoes.

Constantly changing weather conditions over semi-arid environments, in particular, are prone to these unusual tropospheric phenomena that facilitate radio waves to have higher signal strengths and to travel longer distances than expected. Therefore, the influence of evaporation ducts on needs to be thoroughly investigated. Planned to develop an artificial neural network (ANN) model to predict the presence of ducting phenomena for a specific time, taking into account ground values of atmospheric pressure, relative humidity and temperature.
Inter comparisons with other techniques will be essential to place the results of this analysis in the context of prior research with scanning Doppler radars.