CHAPTER V

SUMMARY OF THE RESULTS AND THE CONCLUSIONS

The variational coefficients for East, West, North, South and Vertical (meson) telescopes at Ahmedabad have been computed for different values of $\sqrt{3}$ and $E_{\text{max}}$. To overcome the difficulties in the correction of meson intensity due to atmospheric temperature variation data of difference-telescopes have been extensively used by the author. At least, to a first degree of approximation the difference-telescope data is assumed to be free from the atmospheric temperature variations. In order to relate the secondary variations observed by difference-telescopes, with the primary anisotropy, the variational coefficients for difference telescopes at Ahmedabad have also been calculated.

Daily variations observed by difference-telescopes (meson) at Ahmedabad during 1968 to 1970 are presented. Data from a number of super neutron monitors, for the year 1968 and 1969 are also presented and meson observations are compared with the neutron observations.

Spectrum analysis of the daily variations both on a day-to-day basis and on an yearly average basis have been done. An attempt is made to study the anisotropies related to the interplanetary magnetic field directions and the cosmic ray density gradients for the years 1968 and 1969. Following are the main conclusions drawn from the above studies:
1) The diurnal variations observed by the various difference-telescopes at Ahmedabad during 1968 to 1970 are consistent with the corotational anisotropy with $E_{\text{max}}$ being 80 to 100 GeV.

2) Spectral exponent $\beta$ for diurnal as well as for semi-diurnal anisotropy fluctuate considerably on a day-to-day basis. However the average value of $\beta$ is zero for the diurnal anisotropy and $\beta$ is +1 for the semi-diurnal anisotropy.

3) The average diurnal anisotropy is energy independent and it is along 1800 hour direction. The appropriate value of $E_{\text{max}}$ applicable during this period is $85 \pm 10$ GeV. Diurnal anisotropy does not exhibit any significant change from 1968 to 1970.

4) The average semi-diurnal anisotropy is $E^{+1}$ dependent and the value of $E_{\text{max}}$ applicable for the semi-diurnal anisotropy is $>125$ GeV. Amplitude of the semi-diurnal anisotropy seems to show a gradual decrease from 1968 to 1970. The time of maximum of the semi-diurnal anisotropy is along $\sim 0300$ hours direction and is perpendicular to the interplanetary magnetic field vector.

5) Significant differences are obtained in the average behaviour of diurnal anisotropies during days on which the interplanetary magnetic field is towards the sun (negative) and days on which it is away from the sun (positive). In 1968, the amplitude of the anisotropy, had a larger amplitude during positive polarity days than that during the negative polarity days. The time of maximum of the anisotropy was earlier for
positive polarity days and it was later during negative polarity
days. Approximately opposite results are obtained during 1969.
The vector difference between the diurnal variations observed
in positive and negative polarity days have been used to study
the anisotropy related to the interplanetary magnetic field
direction.

6) The interplanetary magnetic field related anisotropies
resulting due to the cosmic ray density gradients and the ipmf.
direction has a positive exponent of the energy spectrum of
variation.

7) The ipmf. related gradient anisotropy in 1968 shows an
amplitude of \((0.0047 \pm 0.0007) E^+\). The time of maximum is at
16.3 hours. The results are in substantial agreement with the
results reported by other workers. The ipmf. related anisotropy
in 1969, however, shows a drastic change from that observed in
1968. The time of maximum observed in 1969 is 5.7 hours with
its amplitude being about one third of that in 1968.

8) The upper limit of the energy \(E_{max}\) applicable for the
ipmf. related anisotropy is about 55-85 GeV which is lower
than the value of \(E_{max}\) obtained for the corotational anisotropy.

9) The reversal in interplanetary magnetic field related
anisotropy can possibly be explained as due to the reversal in
the polarity of \(B_z\) during positive and negative sector of the
interplanetary magnetic field in 1969 as compared to that in
1968. The hypothesis however requires confirmation from actual observations.

10) Sidereal anisotropy vector resulting from the azimuthal component of the interplanetary magnetic field and the radial cosmic ray density gradient has a positive spectral exponent and an $E_{\text{max}} = 85$ GeV. The amplitude of the anisotropy in space is $(0.0049 \pm 0.0006) E^{+1}$ and time of maximum is in 0700 hour direction. The results about sidereal anisotropy are in agreement with the results presented by Swinson (1971) with Chacaltaya and Bolivia underground meson data.

11) We conclude that the diurnal anisotropy can satisfactorily be explained by equation 1.28 (Chapter I, Gleeson's equation) on a day-to-day basis as well as on an average basis. This gives us a method by which the cosmic ray density gradients can be estimated by using measured anisotropy and the interplanetary magnetic field.