Dissertation on

TIME VARIATION OF COSMIC RAY INTENSITY AND OF GEOMAGNETIC FIELD

Presented

by

K. NARAYANAN NAIR

for the degree of

DOCTOR OF PHILOSOPHY

of the

University of Kerala

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B4200

June 1971

Physical Research Laboratory
Ahmedabad
India.

STATEMENT

The electromagnetic state of the interplanetary medium is a subject of great interest. Studies of cosmic ray time variations and geomagnetic field perturbations provide excellent means of probing the spatial and temporal variations of the plasma in interplanetary space.

The investigations reported in this thesis cover: (a) A study using crossed East-West cosmic ray telescopes at an equatorial station. A comparison of the daily variation of the intensity measured by the two telescopes, as they scan the celestial sphere provides a clue to the relative contributions of the anisotropy of primary cosmic rays and of a source due to an uncorrected meteorological effect or of other local origin. Chapters 1 and 2 deal with this study. (b) Using the records of magnetometers from low latitude stations, the extent to which the features of the daily variation of H can be related to the characteristics of the interplanetary plasma impinging on the magnetosphere are investigated Chapters 3 and 4 summarise these investigations. (c) In Chapter 5 the summary and the conclusions of the above studies are reported. Therein it is also pointed out how ΔH, the daily range of the horizontal component of the earth's magnetic field at a low latitude station away from the effects of the equatorial electrojet, can be used for probing the electromagnetic state of interplanetary space, in the neighbourhood of the earth

In April 1963 the author undertook the construction of directional counter telescopes pointing to east and west at

Trivandrum (Geographic latitude 8.4°N and geographic longitude 76.9°E) close to the dip equator. The unit functioned from January 1964 to December 1966. The author also maintained vertical meson telescopes which were already in operation at Trivandrum. The author was closely associated with the construction of all the Geiger counters used in the units. Data for the period January 1964 to December 1966 is analysed.

For the study of the solar wind-magnetosphere interaction, the author used geomagnetic field data from Alibag (Geomagnetic latitude 9.5°N), Honolulu (Geomagnetic latitude 21.3°N), Guam (Geomagnetic latitude 4.0°N) and Trivandrum (Geomagnetic latitude 1.1°S) along with solar wind plasma data from IMP-1 satellite and interplanetary magnetic field data from satellites IMP-1, IMP-3 and Explorer-33.

The material presented in the thesis covers the following investigations:

(a.1) Computation of the variational coefficient for deriving the effect related to the primary component of cosmic-ray, from the observed variations of the secondary intensity, by directional telescopes.

(a.2) Patel et al (1968) have reported the direction and amplitude in space of the diurnal and semi-diurnal anisotropy and β, the exponent of the variational part of the energy spectrum of the primary anisotropy on a day-to-day basis. Using their values, the expected

amplitude and phase of the diurnal and semi-diurnal components due to primary anisotropy at the respective instruments (along east, vertical and west directions) at Trivandrum on a day-to-day basis for the period 1964 to 1966 are evaluated. The modulation of μmeson intensity, probably due to temperature variations in the atmosphere is studied through a comparison of the observed pressure-corrected daily variation and the computed daily variation.

(b.1) The question whether ΔH, the daily range of the horizontal component of the earth's magnetic field at a low latitude station away from the effects of the equatorial electrojet represents primarily an increase on the day side over a base level $H_{minimum}$ or alternatively it is a decrease on the night side from a base level at $H_{maximum}$ is investigated.

(b.2) The ionospheric and magnetospheric contributions to ΔH are estimated.

(b.3) Investigation of the strength of the equatorial electrojet in relation to the drift speeds of the irregularities in the E and F regions of the ionosphere at Trivandrum is carried out

(b.4) A study of the enhancement of the equatorial electrojet during equinoxes is made.

(b.5) The deformation of the magnetosphere by the impact of the solar plasma and its effects on $\triangle H$ are studied.

(b.6) The effects caused by the fluctuations of the north-south component of the interplanetary magnetic field, on $\triangle H$ are looked into.

(b.7) The experimentally observed shift of the time of minimum of H from morning hours during quiet days to evening hours during disturbed days is examined on the basis of the drift motion of charged particles, injected through the tail of the magnetosphere in the presence of a co-rotational electric field and geomagnetic field gradients.

(c) Relative contributions of (i) the dynamo current mainly at the ionospheric E-region (ii) the surface currents at the magnetospause and (iii) the currents in the magnetosphere namely the tail currents, the eccentric ring current and the partial ring current, to $\triangle H$ are examined.

(VIKRAM A. SARABHAI)

(K. NARAYANAN NAIR)

27/6/1971.

ACKNOWLEDGEMENT

The author wishes to acknowledge with gratitude his indebtedness to Prof. Vikram A. Sarabhai for his guidance, supervision and encouragement in carrying out the work presented in this thesis.

The author is thankful to Professors R. P. Kane, N.W. Nerurkar, P.D. Bhavsar, U.R. Rao, R.G. Rastogi, P.R. Pisharoty, and to his colleagues Drs. M.S. Dhanju, P.N. Pathak, D.M. Patel and Mr. L.V. Kargathra for useful discussions. The author is thankful to Mr. S.R. Thakore, Chief of the Computing Centre, Physical Research Laboratory, for giving the computer facilities.

Thanks are due to Messrs. M.V. Bhavsar, D.K. Patel and K.C. Patel for their help in processing of the data, and to Mr. K.P.G. Nair for neat typing of the thesis.

The author is grateful to Dr. B.N. Bhargava for supplying unpublished magnetic data from Alibag, to Dr. H.S. Bridge for supplying the solar wind plasma data from IMP-1 satellite and to Dr. C.P. Sonett for making available to the author the unpublished interplanetary magnetic field data from satellite Explorer-33. Thanks are due to Dr. N.F. Ness and to the Director, World Data Centre-A, Greenbelt for supplying interplanetary magnetic field data from satellite IMP-1 and IMP-3.

The author is grateful to the Department of Atomic Energy, Government of India, for financial support.

K. NARAYANAN NAIR

The work presented in this thesis has been published in various international journals and presented in various international symposia.

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