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Bifurcations in the *F*-region at Baguio, 1952-1957

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Abstract—A 5-year statistical survey of bifurcations in the *F*-region at Baguio is presented and analysed in the light of a parametric mechanism of the v–R relations of the *F1*- and *F2*-layers. The conclusion is reached that two of the features of bifurcation-statistics are mainly due to variations in layer heights and thicknesses with season and solar activity respectively.

Introduction

It has often been noticed in some places, e.g. Lindau (Becker, 1956) and Slough (Piggott, 1956), that bifurcations occur more often at sunspot-minimum than at sunspot-maximum. But this does not seem to be true at other places, e.g. Singapore (Piggott, 1956). Since bifurcation occurrence evidently varies with place as well as with solar-cycle epoch, this brings up the problem of establishing these variations on a theoretical basis in conformity with the current physical theories of the ionosphere. As an approach to this problem, an initial survey is made at Baguio, Philippines, near the magnetic equator. A statistical picture of bifurcations for the 5 year period 1952–1957 is presented and examined for its most prominent features. By setting up a parametric mechanism, these features are examined and qualitatively correlated with solar-cycle variations. It is hoped that this approach, if satisfactory, would be used at other locations, and perhaps make available to theoreticians the vast accumulation of untapped data on bifurcations, as an additional convenient semi-empirical check on physical theories of the *F*-region.

Presentation of Data

Bifurcation is defined as the clear separation of the *F1*- and *F2*-layers such that the *F1* critical frequency can be accurately measured. The monthly day-by-hour records at Baguio provide a rapid way of obtaining the percentage-occurrence of bifurcations for each month. Nine daytime hourly records, 0800 to 1600, are considered each day. The total number of numerical entries for *F1* critical frequency for each month—divided by the total number of daytime-hourly records of that month (usually 270 or 279)—is the percentage-occurrence for that month. The sixty-six such values from May 1952 to October 1957 are presented graphically in Fig. 1. The graph reveals two outstanding features: (1) the decrease of bifurcation-occurrence during sunspot-maximum, and (2) the seasonal variations, producing two maxima each year, one in summer and another in winter, the former being higher than the latter.

Discussion

Mechanism of bifurcation

The first step towards explaining the above features is to consider the mechanism of bifurcation. Following Appleton's suggestion as later developed by Ratcliffe