

JOURNAL OF
THE RADIO RESEARCH LABORATORIES

MARCH, 1954

CONTENTS

ABSTRACT	1
I. INTRODUCTION	3
1.1. General scope of this paper	3
1.2. Factors having influence on the electron density variation	3
1.21. Diffusion of electrons	3
1.22. Temperature variation of the atmosphere	4
1.23. Pressure variation in the neighbourhood of an ionized layer	5
1.24. Horizontal and vertical shift of ionized layers	5
1.3. Some remarks on the observational data used	7
II. A GENERAL SURVEY ON THE RECOMBINATION THEORY AND THE ATTACHMENT THEORY	9
2.1. Recombination theory	9
2.11. First difficulty of the recombination theory	10
2.12. Ionic recombination theory	10
2.13. Second difficulty of the recombination theory	11
2.14. Third difficulty of the recombination theory	11
2.15. Another evidence against the recombination theory	12
2.2. Difficulties of the attachment theory	13
2.3. Mechanism of electron disappearance	14
III. INFLUENCE OF ELECTRON DIFFUSION ON THE ELECTRON DENSITY VARIATION	17
3.1. Diffusion of electrons and ions in the ionosphere	17
3.2. Mathematical formulation of the problem	17
3.3. Solution of the differential equation	18
3.4. A special case where the initial height distribution of N is given by δ -function	20

3.5.	Numerical values of the parameters	22
3.6.	Calculated results	24
3.7.	Application of the results to actual ionospheric problems	26
IV. INFLUENCE OF TEMPERATURE AND PRESSURE VARIATION ON THE ELECTRON DENSITY VARIATION		29
4.1.	Statistical treatment of the electron density variation	29
4.2.	Method of statistical treatment	29
4.3.	Results obtained by the statistical method	31
4.4.	Discussions of the results	32
4.5.	Conclusion and summary of the statistical study	33
V. ANALYSIS OF AVERAGE VARIATIONS IN ELECTRON DENSITY OF THE F2 LAYER, TEMPERATURE VARIATION BEING TAKEN INTO CONSIDERATION		34
5.1.	Analysis of average variations in electron density	34
5.11.	A brief review of previous works	34
5.12.	Leading principle of our procedure	35
5.2.	Necessity for taking the temperature variation into consideration	35
5.3.	Mathematical formulation of the method of analysis	36
5.31.	Solution of the equation when H' as well as H is constant	38
5.311.	Special case where $H'=\infty$ and $\lambda=0$	38
5.312.	Special case where H' is finite, $\lambda\neq 0$, and $r=0$	38
5.32.	Solution of the equation when H' as well as H is propor- tional to T	39
5.321.	Special case where $r=0$ and $\lambda=0$	39
5.322.	Special case where $r=-1$ and $\lambda=0$	40
5.4.	Analysis of observational data on the basis of the recombination theory	40
5.41.	Method of determining the recombination coefficient	40
5.42.	Effect of the value adopted for r on the temperature varia- tion	42
5.43.	Results of analysis on the basis of the recombination theory	42
5.44.	Solar cycle variation in the recombination coefficient	45
5.5.	Analysis of observational data on the basis of the attachment theory	46
5.51.	Method of analysis for the case $r=0$	47
5.52.	Results of analysis on the basis of the attachment theory	48
5.521.	Discussion on the obtained values of the parameters	50
5.53.	Further evidence of the inappropriateness of the recombination theory	53

5.54. Comparison of the results obtained in the cases where H' is constant or proportional to T	54
5.55. Effect of the value adopted for r on the temperature variation	56
5.56. Effect of λ on the temperature variation and on the value of B_0	58
5.6. Brief theoretical consideration on the temperature variation after sunset	60
5.7. Summary of the results obtained in this chapter	61

(to be continued)