

MODELLING OF GROUNDWATER LEVELS AND SALINITY USING ARTIFICIAL NEURAL NETWORKS, GEOSTATISTICS AND REMOTE SENSING

by
H. R. PATEL

*Thesis submitted
in fulfilment of the requirements of
the degree of*
DOCTOR OF PHILOSOPHY

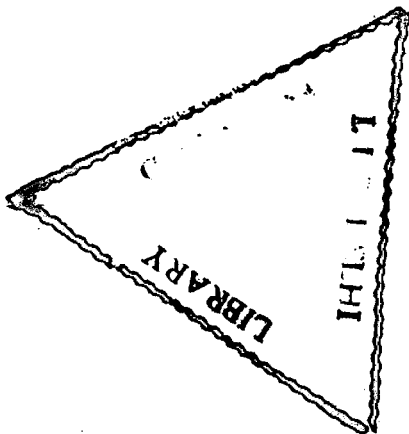
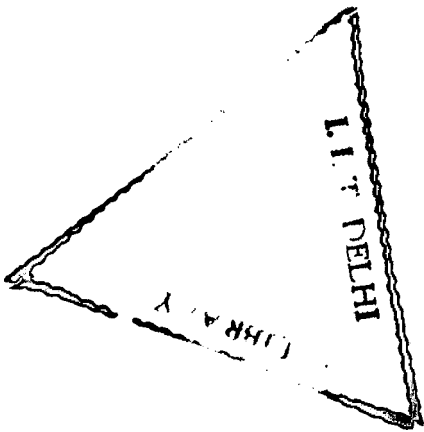


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CERTIFICATE

This is to certify that the thesis entitled **MODELLING OF GROUNDWATER LEVELS AND SALINITY USING ARTIFICIAL NEURAL NETWORKS, GEOSTATISTICS AND REMOTE SENSING** being submitted by **H.R.Patel** for the award of the Degree of Philosophy, is a record of bonafide research work carried out by him. **Mr. H.R.Patel** has worked under our guidance and supervision for submission of this thesis, which to our knowledge, has reached the requisite standard.

This thesis, or any part thereof, has not been submitted to any other University or Institute for the award of any degree or diploma.

Rema Devi

Dr(Mrs) Rema Devi
Associate Professor

M.D. Joshi

Dr. M.D.Joshi
Associate Professor

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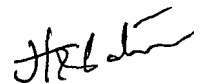
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H.R. PATEL

ABSTRACT

Groundwater is considered as the most widely used source of water. In the semiarid environment, the importance of good quality groundwater is more, as generally it is the only source of water and also because of quality problems that may arise because of endemic soil salinity. Further aggravated quality problems may arise in the case of irrigated agriculture in a semiarid environment.

The spatial extent, distribution and dynamics of groundwater levels and salinity are basic information needed for water resource management. This study concentrates on the spatial variability of groundwater level and quality in a canal irrigated semiarid environment.

The spatial character of groundwater levels and groundwater quality (EC value) are investigated, using data obtained on spatially irregular sampling. The analysis is based on a set of diverse and complementary methods; Artificial Neural Networks, Geostatistics, and Remotesensing. The study area covers Thasara, Anand, and Nadiad blocks of the Mahi Right Bank Canal Command Area in Gujarat State.

A Geostatistical process, that defines the autocorrelation (semivariogram) between the sample points is used for presenting and modelling the spatial variability of groundwater levels and salinity. The semivariograms have been modelled using one of the five models (linear, power, spherical, gaussian, and exponential). A two step process is used to select semivariogram models from the measured data. First, the experimental semivariograms are computed using measured data. Subsequently, semivariogram models are chosen based on the experimental semivariograms and then finalized through crossvalidation. The fictitious point method is used to crossvalidate the models. Directional semivariograms are used to

determine anisotropy in groundwater studies. Groundwater salinity has been additionally modelled using Hole effect model. A multilayer feedforward Artificial Neural Network with sigmoid activation function and trained by Backpropagation algorithm (to minimize quadratic error criteria) is used to successfully model the complex relationship between groundwater levels and groundwater quality. Multispectral, multitemporal, data from IRS sensors have been used to study spatial variability of waterlogging and salinity in the command area. Good supportive evidences for modelling seems to be available with the analysis of remotely sensed data.

CONTENTS

	Page No.
ABSTRACT	v
LIST OF TABLES	vii
LIST OF FIGURES	ix
LIST OF NOTATIONS	xi
CHAPTER 1 INTRODUCTION	
1.1 GENERAL	1
1.2 NEED FOR STUDIES ON GROUNDWATER LEVELS AND QUALITY	2
1.3 OBJECTIVES	3
1.4 METHODOLOGY	5
1.5 LAYOUT OF THE THESIS	7
CHAPTER 2 METHODOLOGY	
2.1 INTRODUCTION	8
2.2 GEOSTATISTICS	9
2.2.1 Stationarity	10
2.2.2 Experimental Semivariogram	13
2.2.3 Models of Semivariograms	13
2.2.4 Formulation of Kriging Method	14
2.3 ARTIFICIAL NEURAL NETWORKS	16
2.3.1 Introduction	16
2.3.2 Working Principle	17

2.3.3	Forward-Propagation Step	21
2.3.4	Backward-Propagation Algorithm	23
2.3.5	Structure Of Ann Model	25
2.3.6	Pattern Normalization	25
2.3.7	Parameter's Initialization	26
2.3.8	Learning Rate And Momentum Coefficients	26
2.4	REMOTE SENSING	26
2.4.1	Introduction	26
2.4.2	Spectral Reflectance	27
2.4.3	Spectral Bands	28
2.4.4	Digital Image Processing	30
2.5	CONCLUSION	32
CHAPTER 3 LITERATURE REVIEW		
3.1	INTRODUCTION	33
3.2	ARTIFICIAL NEURAL NETWORKS	33
3.3	GEOSTATISTICS	35
3.4	REMOTE SENSING	68
3.5	CONCLUSION	111
CHAPTER 4 STUDY AREA		
4.1.	INTRODUCTION	116
4.2	STUDY AREA	117
4.2.1	Climate	117

4.2.2	Topography	119
4.2.3	Geology	119
4.2.4	Soils	120
4.2.5	Geohydrology	120
4.2.6	Cropping pattern	121
4.2.7	Groundwater and its management	121
4.3	DATA SPECIFICATION	122
4.4	CONCLUSION	122
 CHAPTER 5 RESULTS AND DISCUSSION		
5.1	INTRODUCTION	124
5.2	BASIC APPROACH	125
5.3	MODELLING OF THE GROUND WATER	130
	5.3.1 Geostatistical Modelling	130
	5.3.2 ANN Modelling	150
5.4	WATER QUALITY MODELLING (EC MODELLING)	157
	5.4.1 Geostatistical Modelling	161
	5.4.2 ANN Modelling	178
5.5	REMOTE SENSING	188
	5.5.1 Selection of Data	190
	5.5.2 Analysis and Interpretation of Data	192
5.6	CONCLUSIONS	220

CHAPTER 6 CONCLUSIONS

6.1	INTRODUCTION	221
6.2	GEOSTATISTICAL MODELLING	222
6.3	ANN MODELLING	226
	6.3.1 General	226
6.4	REMOTE SENSING	229
6.5	MEETING THE SPECIFIC OBJECTIVE	230
6.6	CONTRIBUTION FROM THE PRESENT STUDY	232
	6.6.1 Extension of Knowledge	233
	6.6.2 Modern Techniques to Handle Real World Problems	234
	6.6.3 At Personal Level	235
6.5	ASSESSMENT OF SCOPE	236
	REFERENCES	238