and modeling of the atmosphere, oceans and interactions. (2) Multi-, hyper- and ultra-spectral remote sensing technology, techniques and applications, (3) Remote sensing of the marine environment, (4) GEOSS and next generation sensors and missions, (5) Remote sensing of the atmosphere and clouds, (6) Lidar remote sensing for environmental monitoring, (7) Microwave remote sensing of the atmosphere and environment, (8) Agriculture and hydrology applications of remote sensing and (9) Disaster forewarning, diagnostic methods and management.

After the inaugural function on 13th November, five parallel plenary sessions were held on the above main themes (1), (2), (4), (5) and (6) which saw a galaxy of experts attending to the audo-visual presentations made under sub-themes: Satellite data assimilation and numerical modeling; Atmospheric Infrared Sounder; Product retrieval, validation and application; Atmospheric effect and correction, inverse modeling and new sensors; Clouds and aerosols; Application of SAR data to resource and disaster management, and crop management and forecasting-1. 14th and 15th November saw continuation of presentations on the above sub-themes and on some new themes such as radiative transfer modeling and geophysical parameter retrieval. Presentations were made on topics ranging from "GIS and expert system diagnostic tools for disease and pest management in pearl millet crop" by ISRO scientists to "Monitoring fire and smoke emissions with the hazard mapping system" by NIAA experts.

Apart from oral presentations on sub-themes like land surface classification and applications, coastal ecosystems and phenomena – Monitoring of the coastal zone, poster sessions were held on 16th November comprising of 200 posters, of which 90 were from Indian research organizations, on various topics ranging from "Characteristics of tsunami inundation area in the eastern part of Sri Lanka due to the 2004 Sumatra earthquake observed in high resolution satellite images" by Japanese scientists to "A new remote sensing model for retrieving snow depth within 30 centimeter using MODIS data" by Chinese researchers. On the final day of the event oral sessions were held which were devoted to open ocean processes, circulation and carbon cycle, flood risk assessment and prediction and snow and ice. Researchers from remote sensing section of NCAOR also gave presentations.

The symposium has opened new avenue and challenges in designing of next-generation sensors for disaster forewarning and management, agriculture and hydrological applications, microwave and lidar remote sensing for environmental monitoring etc. The fact that about a one third of the total presentations and posters were from Indian researchers shows that the country is catching up with the Japanese, Chinese and US counterparts in optical engineering and modeling studies using remote sensing data. This brought together policy makers, scientists, and engineers from world over for exchange of ideas and sharing of current knowledge of recent developments as well as expected societal benefits and socio-economic payoffs.

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GROUNDWATER SIMULATION STUDIES – WITH A CASE STUDY OF WESTERN YAMUNA CANAL COMMAND, HARYANA

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EXTENDED ABSTRACT

Introduction

The hydrogeologists of the modern world are required to predict about the expected groundwater levels in 2020 or to predict what will be the impact on the phreatic aquifer if some desired quantum of water is to be pumped out of the deeper, believed to be confined aquifer or the most likely pathway of the contaminants which have been detected in groundwater, to find an economically viable solution. The answers to these questions involve a correct conceptual model, selection of appropriate parameter values to describe

K.R. Karanth Endowment Lecture delivered on 27 November 2006 at the Geological Society of India, Bangalore.

spatial variability within the groundwater flow system, as well as spatial and temporal trends in hydrologic systems and past and future trends in water levels, to use the groundwater model to meet the challenge of such prediction with a sound scientific justification, even to stand in the court of law. Further sustainable development and management of water resources require planning. Planning methodologies require proper understanding of the processes that control occurrence and movement of groundwater. The groundwater simulation studies are one of the efficient and reliable tools to understand these processes.

Mathematical Modelling

Through modelling we try to represent an approximation of a field situation. In case of ground water simulation studies the mathematical model simulates ground water flow indirectly by means of governing equations to represent the physical processes that occur in the system, together with equations that describe heads or flows along the boundaries of the area for which the model has been developed. The groundwater simulation studies require the data (Mary P. Anderson et al. 1992) to know the geology, topography and thickness of aquifers of the area, water table and peizometric levels, details of surface water bodies in the area and their discharges, the aquifer parameters like hydraulic conductivity and specific yield/specific storage, evapotranspiration details, groundwater recharge and discharge details, surface water – groundwater interaction and such more details as per the objective of the study for conceptualization and development of the flow Model.

Steps in Groundwater flow Modelling

The various steps in Groundwater simulation studies are Devising a model, Calibration of the model and Validation of the model. The ground water flow modelling include the development of mathematical model to simulate hydrogeological conditions of ground water flow systems in the area and then after calibration of this model the heads produced are used to test the objective or develop optimal groundwater development plan or develop various scenarios. For success of any simulation studies, it is necessary that the input data is more precise and accurate, the monitoring data used for the model are of long duration, with a reasonable frequency for desired accuracy of prediction.

Devising a model involves developing a conceptual model using the data available as mentioned above, including finalization of the boundary conditions, the hydro-stratigraphic units and the flow system. Then the modeling steps involved include Laying out the grid, defining model layers, orientation of the grid, assignment of aquifer parameters, assignment of initial heads, finalization of packages and assigning data as per the requirement of these packages, assigning stress period and then finally running the model. The main purpose of the model is to predict the future situations and for that it is essential to establish that the model can reproduce field-measured heads and flows. Calibration refers to demonstration that the model is capable of producing field measured heads and flows.

MODFLOW is a computer program that numerically solves the three-dimensional ground-water flow equation for a porous medium by using a finite-difference method. MODFLOW was originally documented by Mc Donald and Harbaugh (1984). MODFLOW has now become a worldwide standard GW flow model, which was indicated by the international Seminar held in 2006 to discuss various aspects of MODFLOW.

Development of Mathematical Model for Western Yamuna Canal Command, Haryana

A mathematical model was developed for parts of the WYC Command to simulate hydrogeological conditions and ground water flow. The main objectives of the study were quantitative assessment of ground water in space and time of the area under study, to gain insight into the surface water- ground water interactions and to develop optimal allocation plan of surface and ground water use.

The groundwater flow modelling included the development of mathematical model to simulate hydrogeological conditions of ground water flow systems in the area. The model area was imported in the Model (Software – Visual MODFLOW). The boundaries were assigned (River Yamuna in the east, basin boundary in the west, flux boundary in the North and south) and the study area was dicretized in to grids of 1x1 km. Vertically the study area was divided into three layers with an unconfined layer at the top (Layer-I) and a confined/ unconfined layer at the bottom (Layer-III) separated by a confining layer (Layer-II). The various parameters like Hydraulic conductivity and Specific yield/specific storage were assigned to various layers based on the estimated values of Upper Yamuna Project. The Pan Evaporation data of Karnal was used to assign evapotranspiration vales for the area. Recharge from rainfall and other sources like surface water bodies, surface and ground water irrigation were compiled from the ground water estimation report for assigning to the model. The Western Yamuna Canal, Augmentation Canal and other major canal and major drains were digitized and simulated in the Model to account for their recharge to the ground water system. The pumping well data is assigned on the basis of pumping rate in each block in monsoon and non-monsoon for domestic and agricultural sector. The observation wells in phreatic and confined aquifer were utilized for calibration of this model. The developed model was calibrated. Several runs were taken to calibrate the model parameters, initially at steady state and then in the transient state. Then several alternative scenarios were developed for management of water resources.

PLANET EARTH – FOCAL THEME FOR THE 94th SESSION OF INDIAN SCIENCE CONGRESS

The 94th session of the Indian Science Congress Association (ISCA) was inaugurated by the Honorable Prime Minister of India, Dr. Manmohan Singh on 3rd January, 2007 at Annamalai University, Chidambaram. The focal theme of the 94th Science Congress was "Planet Earth" to highlight the importance of Earth Sciences in the 21st century, specifically considering the important role that India has to play as an emerging Economic Power. The focus was for integrative investigations of the Planet Earth in order to improve the quality of life with least adverse impact on the environment to achieve our goal of developing and sustaining a knowledge society. More than 5000 delegates including two Nobel Laureates and about 75 foreign delegates attended the Science Congress.

The Prime Minister in his inaugural address spoke "of science and public policy to unitedly address this great challenge. Sri Kapil Sibal, Union Minister of Science and Technology, in his address congratulated the ISCA for taking the Science Congress for the first time to salubrious environment away from the hustle and bustles of cities in the midst of countryside and selecting the theme "Planet Earth" as a holistic, all encompassing system. Prof. Harsh Gupta, General President of the 94th Indian Science Congress, in his inaugural speech emphasized the need to strengthen our R&D expertise in the vital areas of Monsoon Forecast and Climate change, Energy independence, Natural hazard mitigation and Desalination of sea water for providing drinking water in coastal regions. He thanked the Honorable Prime Minister for creating a new Ministry of Earth Sciences and stressed the need to

Sri R.H. Sawkar receiving the Jawaharlal Nehru Birth Centenary Award on behalf of Dr. B.P. Radhakrishna

the many challenges our planet is facing, three I consider are vital to the survival of life on earth. These are the availability of water, food and energy". He expressed that it is the collective responsibility of both science and social develop outreach programs for wider awareness of Earth Sciences.

Honorable President of India Dr. A.P.J. Abdul Kalam addressed the delegates on 5th January, 2007 during the