

National Award in the field of Geoscience & Technology

Dr. Rishi Narain Singh



Dr. Rishi Narain Singh is INSA Senior Scientist at CSIR-National Geophysical Research Institute Hyderabad. He was born in 1943 in the family of a school teacher, in village Bajha, Dist Mirzapur. His initial schooling was in the village. He obtained his M.Sc. and Ph.D. degrees in Geophysics from Banaras Hindu University in 1964 and 1969 respectively. He has been with CSIR-NGRI 1964 except for the duration of 1970-73 (when he was a Post-Doctoral Fellow at Dalhousie University, Halifax and Memorial University of Newfoundland, St Johns', Canada) and 1996-2003. For a brief period during 1977-78 he was an Associate Professor at the Indian Institute of Geomagnetism on deputation. During 1996-99, he was the Scientist-in-charge of CSIR-Centre for Mathematical Modeling and Computer Simulation (CSIR-CMMACS) now renamed as CSIR-Fourth Paradigm Institute, Bengaluru. He consolidated CSIR-CMMACS in-house research activities into frontier areas of climate and environmental modeling, geological modeling, industrial fluid mechanics and nonlinear dynamical systems while continuing to build mathematical modeling bridges with other CSIR laboratories. Here Dr Singh was actively involved in executing program on Indian Ocean Modeling and Dynamics (INDOMOD) of the Department of Ocean Development, which aimed at forecasting of Indian Ocean states using data assimilation methodologies. During 1999-2003 he worked as the Director of CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur. Here he focused on increasing the role of frontier science and modeling in development of innovative environmental technologies and in the environmental decision making in presence of uncertainties. He expanded the research program at CSIR-NEERI to include environmental genomics and environmental material science in addition to geo environmental management.

He has carried out research in mathematical modeling of various geophysical and environmental processes. He applied Thomson-Haskell and propagator matrix methods in modeling of heat conduction processes in stratified crust. He made extensive theoretical investigations on the interpretation of the linear surface heat flow and surface heat generation relationship generally observed in many continental regions. The constants of this relationship have been rigorously interpreted to constrain the distribution of radiogenic heat in the crust, vital for constructing geotherms which are required to quantify the lithospheric geodynamics. He used variational methods, entropy maximizing principle and other inverse methodologies in these investigations. These

studies are also extended to include the stochastic horizontal variation in the radiogenic heat. Effects of random perturbations in the vertical variation of the thermal conductivity and radiogenic heat have been investigated towards construction of geotherms. He modeled thermal and mechanical processes in the Indian continental and oceanic lithosphere by constraining solutions of thermomechanical equations, including moving boundary problems, with geophysical observations such as heat flow, topography, gravity, seismicity, crustal structure etc. He constructed quantitative models for origins of geological features such as the Cuddapah basin, south Indian high grade metamorphic terrains, Afanasi seamount, Carlsberg Ridge, and fracture zones in the Indian Oceanic lithosphere. He modeled transient electromagnetic screening of the idealized ore bodies with a conducting overburden and showed that enhanced anomalous signatures from the ore bodies can be possible. He systematically studied the generation, propagation and decay of planetary waves in the beta-plane approximation of the thick shell model of outer core towards explaining the causes of the geomagnetic secular variation and westward drift. Comprehensive processes of stream-aquifer interaction in the presence of time dependent recharge have been theoretically carried out towards development of groundwater resources. Models of bioremediation of contaminated sites have been constructed. A versatile ecology based technology was innovated and patented for treatment of municipal wastewater and installed at various locations in the country. Effects of uncertainties in sources, parameters, initial and boundary conditions in several geophysical and environmental models have been worked out. He initiated multi-media modeling of fate and transport of pollutants in the environment. Fractal and dynamical system-based nonlinear time series analysis of relative sea level, ocean gravity and bathymetry, pore pressure and air quality data have been carried out. He was involved in initiating research and applications of the inverse theory in geophysics in the country by way of lectures in 1970s. He continues to deliver advanced lectures in geophysical inverse theory at the Academy of Scientific and Innovative Research (AcSIR) at CSIR-NGRI as Emeritus Professor. He frequently delivers invited lectures in advanced geophysical and environmental topics in various institutions in the country. His current research interest lies in modeling of near-surface geophysical and environmental processes, incorporating coupled physical, chemical and biological aspects. This thin zone, extending from bottom of aquifer to the top of tree canopy, contains all vital life support systems and processes which is becoming a grand challenge research problem for geoscientists. Recently thermal model of near subsurface earth combining both air temperature variations and vertical groundwater recharge have been constructed and effects of variations of various controlling parameters have been worked out for application to climate change studies. He also worked recently on resetting of thermoluminescence signals due to heating at earthquake fault surfaces and

within the sand dykes. He has over one hundred and fifty publications and has coordinated over one hundred environmental impact and risk assessment reports. He has co-edited a book entitled "Magmatic and Allied Processes" being published by Springer (2014) wherein he has coauthored three chapters on (i) Parameterized mantle convection analysis for crustal processes, (ii) Models for quantifying melting processes and (iii) Modelling paleogeotherms in the continental lithosphere: A brief review and applications to problems in the Indian subcontinent .

He was awarded the Shanti Swaroop Bhatnagar Prize in 1985 in the field of Earth Science and elected to the fellowships of Indian Academy of Sciences, Indian National Science Academy, Indian Geophysical Union, Association of Exploration Geophysicists and Maharashtra Academy of Sciences. He has been a member of the Sectional Committee (Earth and Planetary Sciences) and Council of the Indian National Science Academy. He is currently a member of the Sectional Committee (Earth and Planetary Sciences) of the Indian Academy of Sciences. He was UGC National Lecturer during 1986-87. He delivered Diamond and Platinum Jubilee Lectures of Indian Science Congress in 1992 and 2006, respectively. He has been leader of the Indian delegation to IUGG in 1999. The Indian Geophysical Union awarded him the Decennial Award in 2004. He has been President of Indian Association of Environmental Management and a Vice-President of the Indian Geophysical Union. He was also Chairman of the Research Council of CSIR-National Environmental Engineering Research Institute, Nagpur.

In recognition of his outstanding contributions to the Geoscience, the Ministry of Earth Sciences honors Dr. Rishi Narain Singh with "National Award in Geoscience & Technology for the year 2014".