

## Padma Shri Award to Dr. Shailesh Nayak

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It is heartening to see an earth scientist, Prof. Shailesh Nayak, is the recipient of this year's Padma awardee. With this he joins a selected few earth scientists of our country who have achieved this distinction.

Dr. Shailesh Nayak although qualified as a geologist at the graduation level, blossomed in the field of earth science in the area of Oceanography and Remote sensing and made many outstanding contributions. He obtained Ph.D. degree in Geology from the M.S University of Baroda in 1980 and joined the Space Applications Centre, Indian Space Research Organisation (ISRO) as a scientist and subsequently became the Director of Marine and Water Resources. During his tenure as the Director of Marine resources he



conceptualised, formulated, and executed many national level projects related to application of satellite data on ocean colour, integrated coastal zone management, snow and glacier studies, and water resources. Generation of detailed information on the Indian coast influenced the development of policy for zoning of coastal zone for regulating coastal activities. He was closely involved in restructuring Coastal Regulation Zone Notification issued by the Ministry of Environment and Forests of the Government of India.

Dr. Shailesh Nayak was appointed as the Director, Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, an autonomous institution under ESSO, in May 2006. At ESSO-INCOIS, he set up a state-of-the-art early warning system for tsunami and storm surges in the Indian Ocean. He was responsible for the conceptualisation and development of marine geographic information systems. He made outstanding contributions in improving the advisory services related to potential fishing zones, ocean state forecast, and Indian Argo project.

Dr. Shailesh Nayak is currently the Director of the National Institute of Advanced Studies, Bengaluru; Chancellor of the TERI School of

Advanced Studies, New Delhi; Editor-in Chief of the Journal of the Indian Society of Remote Sensing; Life Trustee, India International Centre, New Delhi. He is a Member of the Governing Board of the Indian Space Promotion and Authorisation Centre (In-Space); Foundation for Ecological Security, Anand; and National Centre for Sustainable Coastal Zone Management, Chennai. Dr. Nayak is the Chairperson of the Jury for the National Blue Flag Committee; Research Advisory Committee of ESSO-National Antarctic and Ocean Research Centre, Goa; ESSO-National Centre for Coastal Research, Chennai and the Wadia Institute of Himalayan Geology, Dehradun.

Dr. Shailesh Nayak's research studies, wholly carried out in India, led to more than 200 research papers in peer-reviewed International and National journals.

For his scientific contributions, Dr. Nayak has been elected as a Fellow of the Indian National Science Academy, New Delhi; Indian Academy of Sciences, Bengaluru; the National Academy of Sciences, India, Allahabad; the International Society of Photogrammetry and Remote Sensing (ISPRS) and as the Academician of the International Academy of Astronautics, Paris. He has been awarded Honorary degree of Doctor of Science by the Andhra University in 2011, the Assam University in 2013, and the Amity University in 2015. Dr. Nayak is the recipient of the Indian Geophysical Union's Hari Narain Lifetime Achievement Award in Geosciences-2013, the ISCA Vikram Sarabhai Memorial Award, 2012, the Bhaskara Award for 2009 by the Indian Society of Remote Sensing, Dehradun. Dr. Shailesh Nayak is the President of the Indian Geophysical Union, Hyderabad, and the Indian Mangrove Society.

Dr. Shailesh Naik was one of the Vice Presidents of the Geological Society of India. He was the Chairperson, Earth System Science Organisation (ESSO) and Secretary to the Government of India, at the Ministry of Earth Sciences (MoES), between August 2008-2015.

Dr. Shailesh Nayak provided leadership for programs related to science of climate change, weather services, polar science, geoscience, modelling in ocean sciences, ocean survey, resources, and technology. His current research interests are focused on building strategy for blue economy, sustainable development, and science diplomacy.

As the Secretary, MoES, Dr. Shailesh Nayak initiated several new programmes/centres/activities relating to climate change and use of earth system science for overall societal benefit. They include monsoon mission; severe weather; Arctic research; evolution of the Himalaya; earthquake research; ocean biogeochemistry; ocean ecosystem including modelling; multi-hazard warning system; marine resources and Antarctica Data Base Organization and Management; Web and Location-based services; building HPC infrastructure; Development of human resources, etc. Due to his efforts, the forecast for weather

and climate hazards has improved considerably. A Centre for Climate Change Research was established in Pune where a Training School for Climate and Earth System is being set up. National Centres for Seismology and a Coastal Research were initiated. He initiated discussions for the preparation of a national vision document on the role of Earth Sciences in national issues. He also has led an expert group for setting up National GIS which is now under implementation.

Dr. Nayak has made substantial contributions towards the application of geophysical methods for societal benefits. His exemplary leadership in the planning, designing, development of decision support system, and setting up of the state-of-the-art Tsunami Early Warning Centre (TEWC) has provided India, a unique capability that analyses seismic and sea-level data, computes earthquake parameters, selects best possible scenario, generates and disseminates hazard advisory through web- and location-based services to all stakeholders in near-real-time without any manual intervention. These advisories provide travel time and run-up heights in 1800 coastal forecast points, all along the Indian Ocean. This is the only system in the Indian Ocean that has considered both tsunamigenic sources - the Makran coast in the Arabian Sea and the Sumatra subduction zone. This Centre is now the Regional Tsunami Watch Provider and contributes to the Indian Ocean Tsunami Warning System (IOTWS) and it has provided tsunami advisory for all Indian Ocean countries. Since its establishment, this system has performed extremely well. The pioneering work of IOTWS has found entry in the Encyclopedia of Solid Earth.

As the Project Director, Early Warning System for Tsunami and Storm Surge, May 2006, he planned and implemented an Early Warning System involving network of seismic stations, tidal stations, bottom pressure recorders, and real time analysis of data, modelling of travel time, propagation of tsunami wave and inundation and generation of high-resolution bathymetry and coastal topography data. This teamwork is a testimony to his able direction, guidance, coordination of three departments/ministries and fourteen national institutions involving more than 300 scientists to design, develop and making such system operational in a record time of just ten months at a comparatively low cost of Rs.125 crores. Two major R & D projects, on the tectonic modelling of the Andaman Trench and History of Tsunami have been conceptualized and are being implemented through CSIR-NGRI, ISRO-PRL, MOES-NCAOR, IITs and other academic institutions. The capability of India was effectively showcased in international fora. One of the major achievements was that, the project was executed indigenously without foreign collaboration.

As a project Director of India Argo Project, Dr. Nayak has organized activities related to deployment of ARGO floats in the Indian Ocean, reception, and processing of data in near real time, quality checks, generation of products and applications. Various applications of Argo data are being developed.

As Director, INCOIS, Dr. Nayak provided direction and guidance for the societal services in the field of Potential Fishing Zone (PFZ)

and Ocean State Forecast Advisories. The success of PFZ advisories is around 74 per cent and they have led to savings in time and fuel. Due to innovative methods, the user base of fishermen has increased to 27 per cent. The Ocean State Forecast is being widely used by the ships, the Coast Guard and the Indian Navy. A project on 'Chlorophyll Monitoring of the Indian Ocean' was conceptualized by Dr. Shailesh Nayak and is being implemented using MODIS/OCM data. The project is envisaged to help monitor ecosystem's health and will provide input for ecosystem modelling. As Director of INCOIS, various steps were taken by him to increase activities in operational oceanography.

Dr. Shailesh Nayak was also the Principal Investigator for the project on Coastal Studies between January 2004 - April 2006. The project involved studies on inventory, zonation of coral reefs and mangroves, coastal geomorphology, sea level rise, shoreline changes and coastal zone information systems. He also led Snow and Glacier Studies funded by the Ministry of Environment and Forests, Govt. of India which carried out snow monitoring, glacier inventory and retreat, mass balance, information systems. Dr. Shailesh Nayak steered the program on Focal Point, Meteorology and Oceanography (funded by ISRO), and Satellite Coastal and Oceanographic Research funded by the Dept. of Ocean Development, GOI, between 2003 to April 2006, Biological and Geological Oceanography component and Development of Cal Val site in the Lakshadweep Sea. Dr. Nayak has participated in the development of algorithms for retrieving biogeochemical parameters from Ocean Colour Monitor (OCM), its validation and operationalization, and development of methodology for application of OCM data for fisheries and coastal processes.

A unique application was developed under his leadership to locate potential fishing zones in the sea using the satellite-based sea surface temperature, ocean colour, and chlorophyll as an indicator of food. The integration of these data sets along with various physical phenomena such as upwelling, fronts, etc. provided clues for potential fishing zones. The information on fishing grounds along with sea state conditions is provided to all fishermen in the country through various media. These advisories immensely help the fishermen, saving time for the catch and reducing the fuel consumption. Today, fishermen are routinely guided by these advisories. The annual economic benefit as computed by the National Applied Council for Economic Research is US \$ 7 billion. Societally, this work on potential fishing grounds has transformed the lives and economies of thousands of fishermen, a commendable accomplishment in the field of applied earth science.

Dr. Shailesh Nayak's, research and innovative activities have progressed India to the forefront in the use of space and GIS technologies for the coastal/marine processes and hazard mitigation. As Secretary of the Ministry of Earth Sciences, he has provided a new vision and dynamism to the Indian Earth Sciences. Considering the impact of Dr. Nayak's original earth science research to our society, the Govt. of India has rightly conferred on him, the civilian honour 'Padma Shri' in the field of Science and Engineering in 2024.