

**GOVERNMENT OF INDIA  
MINISTRY OF EARTH SCIENCES  
LOK SABHA  
UNSTARRED QUESTION No. 6474  
TO BE ANSWERED ON WEDNESDAY, MAY 06, 2015**

**SCIENTIFIC CORPORATION**

**6474. Dr. Ramesh Pokhriyal, "Nishank":**

**Will the Minister of EARTH SCIENCES be pleased to state:**

- (a) The countries with which agreements have been signed to boost mutual scientific cooperation;**
- (b) The details of work undertaken so far under these agreements;**
- (c) The number of institutions in the country where research is being done for development of world technology at higher levels;**

**ANSWER**

**MINISTER OF STATE FOR MINISTRY OF SCIENCE AND TECHNOLOGY AND MINISTRY  
OF EARTH SCIENCES  
(Shri Y. S. Chowdary)**

- (a) Ministry of Earth Sciences has signed Memorandum of Understanding (MoUs)/ Agreements with the following countries:  
Germany, Indonesia, Japan, Kuwait, Korea, Norway, Qatar, United Kingdom, United States of America, Belmont Forum Countries and BIMSTEC member countries and RIMES member countries.**
- (b) The details are given in Annexure-I.**
- (c) Under Ministry of Earth Sciences, National Institute of Ocean Technology, an autonomous institute, is working towards developing reliable indigenous technology for ocean observations, drinking water, harvesting of non-living and living resources etc. .**

Earth System Science Organization  
Ministry of Earth Sciences

List of MoUs / Agreements signed with various countries

Sl. No.	Name of the country with whom MoU/Agreement/ signed	Year in which signed	Broad objectives	Present Status of implementation	Details of the work undertaken so far
1	MoU between Ministry of Earth Sciences, India and National Oceanic (NOAA) and Atmospheric Administration, USA	16.4.2008	Technical Cooperation in Earth Observations and Earth Sciences.	Ongoing	<p>Various Implementation Agreement (IA) are undertaken with specific strategy with identified PIs from India and US with well defined objectives, deliverables, individual as well as joint roles and monitoring/evaluating mechanism. Ten such agreements have been signed so far in the field of monsoon, ocean observations, tropical cyclone, Tsunami, ocean model and assimilation, INSAT 3D, Predictive Capabilities on Marine Fisheries and Harmful Algal blooms etc. Some of the significant outcomes are placed below:</p> <p>The collaboration has resulted in fundamental understanding of Indian Ocean dynamics and ocean-atmosphere interactions that affect the weather and climate through ocean observations from RAMA moorings. 129 RAMA deployments were under taken during the period 2008 to present. This is evident from the growing RAMA bibliography. Till date, the data from <b>RAMA moorings have been used in 78 articles published in international journals.</b> India is also using RAMA data to generate ocean analysis products through the assimilation. Global ocean analysis using GODAS (Global Ocean Data Assimilation System) by assimilating all available in-situ data forms an important initial condition for seasonal monsoon prediction by coupled model. Considering the mutual benefits and also the importance of RAMA moorings in generating useful data, this activity is continued for additional five years with effect from 16 April 2013.</p> <p>• <b>For Dynamical Seasonal Prediction of Indian Summer</b></p>

					<p><b>Monsoon Rainfall, Monsoon desk has been established under which</b> state-of-art model has been developed, tested and operationalised . <b>Evaluation of the model performance shows 1 day gain in the performance of the flow pattern. Collaborative work for further improved performance over Indian region is on.</b></p> <ul style="list-style-type: none"> <li>• <b>Tropical Cyclone Research</b> : Development and implementation of state-of-the-art NWP modelling system at IMD for tropical cyclone track and intensity has improved the forecasting of tropical cyclone.</li> <li>• The joint work has resulted forecast of Harmful Algal Blooms which is semi operational at present. A workshop on stock assessment techniques is planned in September 2015.</li> </ul>
2	Agreement between Ministry of Earth Sciences, India and Met. Office, <b>United Kingdom</b>	28.8.2008	Collaboration Agreement Met. Office's Unified Earth System Modelling Software.	Ongoing (Present tenure is over in August 2014. A cabinet note on the new agreement has been circulated with India as core member. Comments of Finance Ministry awaited)	<p>Under this MoU, NCMRWF has already implemented the advanced seamless unified Modelling (UM) system of Met Office, UK. A comprehensive evaluation has demonstrated improved performance of the unified model against the performance of the existing model used by the National Weather Service of the country.</p> <p>Currently, the output products forms an important input for the Forecast by IMD.</p> <p>Regional versions of UM at 12, 4 and 1.5 km have also been implemented for high impact weather. Probabilistic forecasts are generated from 44 ensemble members.</p> <p>A new agreement of the UM System consortium as a core partner with UK, Australia and Korea is proposed along with several associate members who will all work towards further improvement of the UM system through joint programs. By becoming a core partner, India will be a member of the consortium board who will be part of strategic planning and decision making process. A coarse resolution coupled model (atmosphere-ocean) using UM for atmosphere and NEMO for ocean has also been implemented and evaluated.</p>

3	Agreement between Ministry of Earth Sciences, India and The Natural Environment Research Council, <b>United Kingdom</b>	17.2.2010	U.K.-India Co-operation Agreement for Joint Research Initiative on the Changing Water Cycle.	Ongoing	Five joint projects were approved following joint evaluation and review process. The Indian PI's were funded by MoES. Some of the salient findings include strong linkage of geomorphic conditions with ground water availability in North west India and linear relationship of rainfall intensity with horizontal moisture flux in Gangetic plain region.
4	MoU between Ministry of Earth Sciences, India and the Korea Meteorological Administration, <b>Korea</b>	29.9.2010	Co-operation in the Field of Earth Sciences and Services.	Ongoing	Based on the bilateral meetings and discussions, joint work are now being undertaken in the prioritized areas of mutual interest. The areas of cooperation include Improvement of Skill of Weather Prediction in Tropics and Asia from days to season, Regional Climate Downscaling through rigorous assessment of the entire South East Asian region , joint development on advanced techniques on Greenhouse Gas monitoring and research, meteorological satellite technologies
5	MoU between Ministry of Earth Sciences and <b>Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences, Germany.</b>	7.1.2011	Implementation, Management and Operation of the International Continental Scientific Drilling Programme	Ongoing	Subsequent to signing of MoU, location of pilot boreholes has been identified in Koyna. Outline of the drill plan have been jointly prepared. The drilling will commence in next one year time.
6	MoU between Ministry of Earth Sciences, India and the Agency for Meteorology Climatology and Geophysics, <b>Indonesia.</b>	25.1.2011	Co-operation on Weather, Climate and Geo-physics Services and early Warning of Coastal Hazards.	Ongoing	The identified areas of technical cooperation are (i) Agromet advisory Service; (ii) Fishery Service (iii) Observing Systems (iv) Climate Change and (v) Tsunami Operations (v) Geophysics(vi) Instrumentation. A team of scientists from BMKG visited IITM Pune for training on the coupled ocean model system. It has been mutually agreed to explore roles of ocean in climate change.
7	Agreement between Ministry of Earth Sciences, India and Africa and Asia Region, Bangkok, <b>Thailand (RIMES).</b>	24.2.2011	Co-operation Agreement on the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia Region.	Ongoing	Under this cooperation, tsunami advisory and ocean state forecasting and improved high resolution weather forecasts are provided to the RIMES member countries. Mangolia, which is one of the RIMES countries is being benefitted with weather information in reducing the livestock mortality. Ocean forecast and Information system is developed for Maldives and daily operational ocean forecast services for ocean waves, currents, winds, tides are disseminated through RIMES and ESSO-INCOIS website. Site specific forecast are disseminated to major fish landing harbours of Maldives. Similar system for Seychelles, Srilanka are in progress and will be operational in couple of month's time.

8	MoU between Ministry of Earth Sciences, India and The Natural Environment Research Council (NERC), United Kingdom	1.3.2013	Cooperation in the field of Earth Sciences	Ongoing	<p>Under the MoU, NERC and ESSO-MoES have signed an Implementation Agreement on “South Asian Monsoon Collaboration” on 11<sup>th</sup> November 2013 to collaborate in monsoon research.</p> <p>Subsequently, joint call was made inviting Indian and UK scientists for proposals in monsoon research. Three collaborative research projects between India and UK scientists are identified for funding. An intense observational campaign will be organized in 2016 that will include NERC aircraft observations.</p>
9	MoU among Ministry of Earth Sciences, India and Belmont Forum countries	2013	To carry out international collaborative research through joint calls for funding, with an aim to deliver knowledge to enable societies to meet sustainable developmental goals in the coming decades.	Ongoing	<p>India is represented in the Belmont Forum by MoES. Under this MoU <b>development of trans-national projects</b> in the area of <b><i>global environmental change and extreme hazardous events</i></b> among member countries are being taken up through identification of <b>Collaborative Research Areas (CRA)</b>. Each country funds its own scientists. Presently India is participating in the areas of Coastal vulnerability, freshwater security, biodiversity and ecosystems, food security. The CRA on Climate services and inter-regional linkages jointly proposed by India and France has been recently launched and the work of successful proposals will be initiated in April 2016.</p>
10	MoA between Ministry of Earth Sciences (through Indian National Centre for Ocean Information Services) with UNESCO	4.7.2013	Setting up of International Training Centre to enable support for capacity building activities in the field of operational oceanogra-	Ongoing	<p>Conducted 11 training programmes aiming at capacity development in the areas of operational oceanography to about 297 trainees, mainly from the Indian Ocean rim countries and Africa. These participants were trained in the areas of Remote Sensing and Potential Fishing Zones (PFZ), Ocean State Forecasting (OSF), Processing of Ocean Colour Data and their applications, Ocean Climate and Modelling, Standard Operating Procedure for Tsunami Warning and Emergency Response, Ensemble Kalman Filters for ocean data assimilation, Ocean information services for cyclone forecasters, Advanced Statistical concepts in Atmospheric and Oceanic Sciences, etc. Established state-of-art 48 seat <b><i>e-class room</i></b> at ESSO-INCOIS now allows participation of trainees in the training programme from distant locations</p>

			phy for the Indian Ocean Rim (IOR) and islands region as well as Africa		
11	MoA among Ministry of Earth Sciences, India and <b>BIMSTEC</b> (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) Member countries	4.3.2014	Establishment of a BIMSTEC Centre for weather & climate	Ongoing	Following the signing of the Memorandum of Association to establish the BIMSTEC Centre for Weather and Climate (BCWC) at NCMRWF during the BIMSTEC Summit on March 04 2014 at Nay Pyi Taw, Myanmar, the BCWC has been formally inaugurated on 28th March 2014. The activities conducted thus far include Training Workshop on "Improved Weather and Climate Predictions" during 26 Aug-01 Sept 2014 at NCMRWF, Noida. 3 countries from the BIMSTEC region participated. A fellowship program for the BIMSTEC countries is also being launched for capacity building.
12	MoU between Ministry of Earth Sciences and <b>National Science Foundation (NSF), USA</b>	29.7.2014	Participation of India in the International Ocean Discovery Program as a member of JOIDES Resolution Consortium	Ongoing	Under this MoU, Indian scientists have been participating in the various expeditions on board D/V JOIDES Resolution. In addition, recently India has mounted a major program of deep-sea drilling in the Arabian Sea basin. Under this Program which is currently in progress on board JOIDES Resolution, drilling is planned at three sites in the Arabian Sea at water depths ranging between 3400 m and 3600 m and to collect three cores of lengths 690m, 1570 m and 950 m below the seabed (totaling over 3.2 km). The drilling activity is scheduled to be completed by 31 <sup>st</sup> May 2015.
13	LoI between Ministry of Earth Sciences and Japan Agency for Marine Earth Science and Technology ( <b>JAMSTEC</b> ), <b>Japan</b>	28.8.2014	Ocean and Earth Science and Technology	Ongoing	A Science meeting to discuss about future course of action including capacity building will be held tentatively in July 2015 in Japan

14	MoU between MoES and University Corporation for Atmospheric Research ( <b>UCAR</b> ), USA	24.09.2014	It will result in improved forecasting skill for benefit of society at large. This will bring academia and scientists together to transform knowledge into service.	Ongoing	Some preliminary work under the said MoU has been initiated. The proposal related to development of Wind Profiler System is currently under consideration between Indian Institute of Tropical Meteorology (ESSO-IITM), Pune, an autonomous organisation under MoES and National Center for Atmospheric Research (NCAR), USA.
15	MoU between Ministry of Earth Sciences and Research Council of Norway, ( <b>RCN Norway</b> )	14.10.2014	Exchange of scientific resources, personnel and technical knowledge to support the improvement or development of programs in Earth Sciences and Services for both parties.	Ongoing	A joint call for undertaking collaborative work between India and Norway was launched in Feb 2015 under the two themes viz: Geo Hazards and Climate Systems in Polar Regions. A total of 19 proposals have been received under these two themes. These proposals will undergo a joint review mechanism. The successful proposals are likely to be funded by October 2015.
16	MoU between ESSO, Ministry of Earth Sciences and The Kuwait Institute for Scientific Research ( <b>KISR</b> ), Kuwait	9.11.2014	Promotion and extension of co-operation in "Scientific Research and Technology De-	Ongoing	Joint workshop is planned in June 2015 to identify challenging and workable joint research proposals between MoES and KISR.

			velopment” in fields of mutual in- terest to both parties”		
17	LoI between Ministry of Earth Sciences and <b>UNESCO</b>	25.11.2014	Cooperation for Reduc- ing Disaster Risks and Capacity Building in Earth Sci- ences	Ongoing	Initial discussions on areas of mutual interest
18	LoI between Ministry of Earth Sciences and The <b>Woods Hole Oceanographic In- stitution (WHOI), USA</b>	23.2.2015	Mutual col- laboration in ocean sci- ence and technology	Ongoing	Discussion on proposed activities is underway.
19	MoU between ESSO- MoES and <b>Qatar Civil Aviation Au- thority, State of Qa- tar</b>	25.3.2015	Scientific and tech- nical coop- eration	Ongoing	Initial discussions on areas of mutual interest
20	MoU between ESSO- MoES and the <b>Helmholtz Associa- tion, Germany</b>	7.4.2015	Cooperation in the field of earth sys- tem sciences	Ongoing	Initial discussions on areas of mutual interest



