

**GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION No. 4626
TO BE ANSWERED ON WEDNESDAY, APRIL 22, 2015**

DROUGHT RESEARCH

4626. SHRI BHAIRON PRASAD MISHRA:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) the reasons for the occurrence of frequent drought and heavy rains at various places every year in the country; and**
- (b) the details of the research work conducted in this regard?**

ANSWER

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

- (a) Madam, rainfall, particularly in the tropical countries like India, is having high spatial and temporal variability. It can be more clearly stated that this variability is due to complex feedback mechanism associated with ocean-land-atmosphere systems. Hence, every place can not receive same amount of rainfall constantly every year. Therefore, any place can potentially experience year-to-year (interannual) and with-in-the year (intraseasonal) rainfall variability (weeks-month) due to global/regional scale circulation anomalies.**
- (b) Continuous R&D efforts have been made to improve the short/medium/long range rainfall prediction as per the details given below.**
 - Under the National Monsoon Mission initiative, institutions of Earth System Science Organisation (ESSO), the Indian Institute of Tropical Meteorology (ESSO-IITM), Pune; India Meteorological Department (ESSO-IMD); Indian National Centre for Ocean Information Services (ESSO-INCOIS), Hyderabad and National Centre for Medium Range Weather Forecasting (ESSO-NCMRWF), NOIDA, have embarked upon to build a state-of-the-art coupled ocean-atmospheric climate model for a) improved prediction of monsoon rainfall on extended range to seasonal time scale (16 days to one season) and b) improved prediction of temperature, rainfall and extreme weather events on short to medium range time scale (up to 15 days), so that forecast skill gets quantitatively improved further for rendering quality operational services of Earth System Science Organization- India Meteorological Department (ESSO-IMD).**
 - The dynamical forecast for 2013 based on this model was 104 to 108 % of LPA and observed rainfall was 106 % of LPA. The forecast for 2014 was 96% of LPA. On the other hand ESSO-IMDs monsoon forecasts based on statistical tools are also found to be reasonably accurate. In addition, the extended range prediction (up to 2 weeks) of monsoon rainfall was initiated during monsoon 2014.**

- **Operational implementation of improved forecast suite of models after the commissioning of the High Performance Computing (HPC) systems have enhanced the weather forecasting capacities through assimilating all available global satellite radiance data for the production of forecast products at 22Km grid globally and 9Kms/3Kms grid over India/regional/mega city domains.**
- **The Performance evaluation of the updated global/meso-scale forecast systems for the past 5-7 years have demonstrated enhanced forecast skill by about 18% quantitatively as far as the track and landfall forecasts of the tropical cyclones are concerned.**
- **ESSO-IMD has operationalized its location specific nowcasting weather service across the country. This service activity currently covers 147 urban centres on experimental basis under which nowcast of severe weather (Thunderstorms; heavy rainfall from lows/depressions over the land) in 3-6h range is issued. Origin, development/movement of severe weather phenomena are regularly monitored through DWRs and with all available other observing systems (AWSs; ARGs; Automatic Weather Observing Systems-AWOS; satellite derived wind vectors, temperature, moisture fields etc.)**
- **ESSO-IMD is issuing special weather forecasts for tourist places and they are available on the National and Regional websites of IMD. Special forecasts are also issued for pilgrim tourists for Char Dham Yatra, Amarnathji Yatra etc. The weather information (Maximum, Minimum temperatures, Rainfall and Sky condition, etc.) and forecast for next 7 days for 310 important cities and towns in all the states and union territories of India including 107 tourist locations, is currently being issued under tourism forecasts by the IMD.**
- **Gramin Krishi Seva Scheme (GKMS) is rendered now on twice-weekly basis in collaboration with State Agricultural Universities (SAUs), institutions of Indian Council of Agricultural Research (ICAR) etc. Realized weather of the previous week and quantitative district level weather forecast for next 5-days in respect of rainfall, maximum temperature, minimum temperature, wind speed, wind direction, relative humidity and clouds as well as weekly cumulative rainfall forecast are provided. Further, crop specific advisories, generated in partnership with SAUs and ICAR, to help the farmers are issued and widely disseminated. The GKMS of ESSO-IMD has been successful in providing the crop specific advisories to the farmers at the district/agro-climatic zone level twice weekly through different print/visual/Radio/ IT based wider dissemination media including short message service (SMS) and Interactive Voice Response Service (IVRS) facilitating for appropriate field level actions.**
- **The Centre for Climate Change Research (CCCR) was established in 2009 under the Earth System Science Organization (ESSO) – Indian Institute of Tropical Meteorology (IITM), Pune of the Ministry of Earth Sciences (MoES) with the mandate to address relevant to the science issues of climate change and to generate most representative climate change scenarios with reduced uncertainty. The CCCR had in fact contributed to the National Communications (NATCOM) by generating and sharing most representative and critical regional scale climate change scenarios to various organizations in India for sector specific impacts including agriculture etc.**

- **Currently, CCCR is leading “Co-ordinated Regional Downscaling Experiment (CORDEX)” for the South Asian region under the aegis of the World Climate Research Program (WCRP) of the World Meteorological Organization (WMO). The CORDEX program provides an important framework for a co-ordinated set of downscaled regional climate simulations for both the historical past and future decades. Training workshops are conducted for end-users, stakeholders in the South Asian region.**
- **ESSO-IMD started working on to build appropriate climate information services under the Global Framework on Climate Services (GFCS) initiative of the WMO to account/assess the impacts of natural variations in the climate and its extremes on various sectors including agriculture. Currently, regular monitoring of climate variability in terms of quantifying the nature of variability is carried out through anomalies of temperature (heat/cold wave); district scale rainfall (above/below normal activity); drought monitoring through standardized precipitation index (SPI) etc. It is expected that these initiatives working intandem with the agriculture and water resources sectors, in particular, would contribute to the improved climate resilience of our agriculture productivity in times to come.**

As per the practice, all newly developed forecast generation models/tools are subjected to thorough near real time performance evolution and wider dissemination of such research advancement through peer reviewed publication and technical reports . Such efforts have increased the total number of peer reviewed research publications in the recent years. List of research publications and citation index (Impact factor) showing the scientific performance are given below.

Year	No. of Papers	Impact Factor
2003	51	85.356
2004	54	70.613
2005	77	104.472
2006	90	203.374
2007	113	152.405
2008	113	184.012
2009	127	236.901
2010	174	322.808
2011	166	314.877
2012	228	422.722
2013	271	546.054
2014	316	715.056
