(b) Integrated Agro-meteorological Advisory Service (IAAS) is rendered now on twice-weekly basis in collaboration with State Agricultural Universities (SAUs), institutions of Indian Council of Agricultural Research (ICAR), etc. District level weather forecast for next 5-days in respect of:

- Rainfall,
- maximum temperature, minimum temperature,
- wind speed, wind direction,
- relative humidity and clouds,
- weekly cumulative rainfall forecast.

are provided. Further, crop specific advisories to help the farmers are issued and widely disseminated. The AAS of ESSO-IMD has been successful in providing the crop specific advisories to the farmers through different print/visual/Radio/IT based media including short message service (SMS) and Interactive Voice Response Service (IVRS) facilitating for appropriate field level actions. Currently, over 3-million farmers are subscribed to receive the SMS based advisories. In an independent survey conducted by National Council of Applied Economic Research (NCAER), New Delhi in 2010 about the utilization, it was concluded that 24% of the farming community has been benefiting from the IAAS service.

Further, Ministry of Agriculture/Commissionarates of Agriculture in various states carry out weekly review of the current rainfall scenario and outlook for the coming week generated by IMD to assess the ground scenario in support of various crop specific agricultural operations (from sowing to harvest) under the umbrella of Crop Weather Watch Group (CWWG). The CWWG also assesses the likely yields based on the above of various commodities in each of the crop season that would have bearing on the economy of the farming community ultimately.

Rains and floods due to global warming

3618. SHRI TARUN VIJAY: Will the Minister of EARTH SCIENCES be pleased to state:

(a) whether unprecedented rains and floods in various parts of the country are due to global warming;

(b) if so, the details thereof;

(c) whether Government has done any study on global warming and its effects caused on the country; and

(d) the details of action plan formulated by Government to deal with the said problem?

THE MINISTER OF EARTH SCIENCES (SHRI S. JAIPAL REDDY): (a) There is no clear cause and effect established between global warming and excessive rains and floods.

(b) Does not arise.

(c) Yes Sir. Monsoon rainfall varies on different spatial and temporal scales. Extreme rainfall events that occur at some isolated places (*viz.* heavy rainfall over Mumbai or in Rajasthan) are highly localized and are part of the natural variability of the Indian monsoon system itself. Although, some recent studies hint at an increasing frequency and intensity of extremes in rainfall during the past 40-50 years, their attribution to global warming is yet to be established. Moreover, the report of the Inter-governmental Panel on Climate Change (IPCC-AR4, 2007) and our country's own assessment using regional climate models indicate that the extremes rainfall events are likely to be more frequent in the later part of the 21st century in the world including India. As regards other extreme weather phenomena, there are many other reasons for their occurrence, which cannot always be related to climate change.

Although, the monsoon rainfall at all India level does not show any trend but on regional scale, areas of increasing trend is discerned. It is not clear if this increasing trend in the heavy rainfall events is attributable to global warming. Summary of the observed long term changes so far include:

(i) Mean annual surface air temperatures show a significant warming of about 0.5 degree C/100 years during the last century.

(ii) No significant long-term trends are reported in the frequencies of large-scale droughts or floods in the summer monsoon season.

(iii) The total frequency of cyclonic storms that form over the Bay of Bengal has remained almost constant.

(iv) Analysis of past tide gauge records for the Indian coastline regions gives an estimate of sea level rise of 1.30 mm/year.

(v) There is evidence that glaciers in Himalayas are receding, however it is unclear as to how much of this recession is attributable to climate change, as glacial retreat is also due to natural long-term inter-glacial cycles.

(vi) Studies were undertaken in four climate sensitive regions of the country, *viz.* Himalayan Region, Western Ghats, North Eastern Region, Coastal Areas to assess the possible impacts on the four sectors viz. agriculture, water, forests and health. A Report entitled, Climate Change & India: A 4×4 Assessment - A Sectoral and Regional Assessment of Impact of Climate Change in 2030s, has been released by the Government during November, 2010 under the aegis of the Indian Network of Climate Change Assessment (INCCA).

(d) Further, the Government has undertaken the following steps in the area of climate Change:

(i) Prime Minister's Council on Climate Change has been constituted to coordinate national action for assessment, adaptation and mitigation of climate change.

(ii) Under the National Action Plan on Climate Change (NAPCC), it is proposed to establish a permanent institutional mechanism that will play a development and coordination role. The NAPCC was released by the Prime Minister on 30th June, 2008.

(iii) Under the NAPCC, eight missions in specific areas of Solar Energy, Enhanced Energy Efficiency, Sustainable Habitat, Water, Sustaining the Himalayan Eco-system, Green India, Sustainable Agriculture and Strategic knowledge for Climate Change have been identified as a part of multipronged, long term and integrated strategies for achieving key developmental goals in the context of climate change by appropriately dealing with possible adverse impacts.

(iv) Constituted an Expert Committee on Climate Change impacts, which is headed by the Principal Scientific Advisor to the Government of India.

(v) Launched a high-priority Programme to address the Science issues of Global and Regional Climate Change (GRCC) with a well-equipped state-of-the-art Center for Climate Change Research (CCCR) at Indian Institute of Tropical Meteorology (IITM), Pune, a unit under Earth System Science Organization (ESSO) for inter-disciplinary research and training in the area of science of climate change.

MoU with Natural Environment Research Council and ESSO

3619. SHRI NAND KUMAR SAI: Will the Minister of EARTH SCIENCES be pleased to state:

(a) whether Government has signed any Memorandum of Understanding (MoU) with the Natural Environment Research Council of UK and the Earth System Science Organisation (ESSO) in the recent past;

(b) if so, the details thereof;

(c) the details of terms and conditions of the said MoU;

(d) the manner in which such an agreement would help in improving our forecasting capabilities; and

(e) the details of status of various ongoing research projects of these organisations?

THE MINISTER OF EARTH SCIENCES (SHRI S. JAIPAL REDDY): (a) Yes Sir.

(b) A MoU was signed on 1st March, 2013 to establish an appropriate research cooperation umbrella between the UK and Indian earth system science, climate and environmental research communities. The endeavour of the MoU will be to promote collaboration in the area of Meteorology, Oceanography, Climate variability and change, hydrology, cryosphere, natural hazards and biodiversity by promoting information sharing and identification of new opportunities of collaboration through networking, exchange of scientific and technical capacities, and co-funding of research projects through joint calls.

(c) It is envisaged that the MoU provides a suitable joint research and development mechanism to address some of the significant science challenges in the Asian region relating to improved understanding of the regional scale monsoon; the possible influence of weather and climate circulation patterns of