Indian Institute of Tropical Meteorology (IITM), Pune

Press handout

India's first multi-petaflops supercomputer to be inaugurated at IITM Pune on 08 January 2018 by Dr. Harsh Vardhan, Union Minister for S&T, Earth Sciences, and Environment, Forest and Climate Change

Honorable Union Minister of Earth Sciences Dr. Harsh Vardhan will dedicate India's first multi-petaflops supercomputer to the nation on 8 Jan 2018.

The Ministry of Earth Sciences (MoES) in its endeavor to provide world class services (Weather, Climate, Ocean, Seismological) to the citizens of India, is constantly striving to upgrade its operational and research activities and other infrastructural facilities.

In order to provide useful services, MoES runs several computationally intensive applications on High performance computers (HPC). In last 10 years, the HPC infrastructure at MoES institutes has grown from 40 Tera flops in 2008 to 1 Peta flops in 2013/14. As a result of providing HPC infrastructure to MoES scientists, in addition to its constant research activity, MoES stands tall in the international weather and climate sciences community and constantly endeveours to provide the best services to the country and the Neighborhood. Some highlights of the services provided by MoES institutes to the country are:

 ➢ Best weather/climate prediction system in terms of accuracy/skill for monsoon climate.
 ➢ Operational forecasts at a very high resolution of 3 km at regional scale and 12 km at global scale for weather forecasts at par with any other leading weather/climate forecast center in the world.
 ➢ Fastest Tsunami alert/advisory to the stakeholders in Asia/Pacific region.
 ➢ Advisories on Potential fishing Zones, operational ocean wave/weather watch forecasts and air quality forecasts, climate projections are provided regularly to the citizens of India.

MoES also plays leadership role in South Asian region by providing more accurate weather/climate forecasts to its neighboring countries.

Hence, constantly augmenting its High Performance Computing infrastructure at regular intervals is mandatory to keep MoES abreast with new technologies and to be at par with other leading weather/climate/ocean service centers worldwide (*see* **Table 1** and **Table 2**).

At present, MoES HPC system stands at #368 position in Top500 list. With around 1.0 PF peak capacity India's ranking in HPC is much below the HPC rankings of major countries that generate weather/climate forecasts. To provide better services and improve its position, MoES has recently augmented its computational capacity up to 6.8 PF installed at two MoES Institutes: 4.0 Peta Flops HPC facility at IITM, Pune and 2.8 Peta Flops at NCMRWF, Noida.

With this augmentation, MoES HPC facility will be India's #1 HPC facility in terms of peak capacity and performance. With the inauguration of this HPC facility on 08 January 2018, India will rise from the 368th position to around the top 30 in the Top500 list of HPC

facilities in the world. In terms of dedicated HPC resources for weather/climate community, India will be placed at the 4th position after Japan, UK and USA.

The HPC facility being inaugurated at IITM will be used for carrying out research on improving weather and climate forecasts and its applications. This MoES HPC facility will also be utilized by other MoES institutes (like INCOIS, IMD, NIOT, NCAOR, NCESS) for research activities to improve their respective weather and climate services.

The second HPC facility at NCMRWF, Noida will be mainly used to cater daily operational forecasts of respective MoES institutes (INCOIS, IMD, IITM, NCMRWF).

This new HPC facility will enable MoES scientists to use more detailed components of the Earth System for making better weather and climate forecasts at very high resolution. The facility is expected to improve the following services:

- Improved weather forecasts at block level over India which can predict extreme weather events.
- High resolution seasonal/extended range forecasts of active/break spells of Monsoon.
- Very high resolution coupled models for prediction of cyclones with more accuracy and lead time.
- Improved Ocean state forecasts including marine water quality forecasts at very high resolution.
- Tsunami forecasts with greater lead time.
- Air quality forecasts for different smart cities
- Climate projections at very high resolution.

This increase in supercomputing power will go a long way in delivering various societal applications committed by MoES. This will also give fillip to research activities not only in MoES but also in other academic institutions working on various problems related to Earth Sciences.

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Table 1: *Top500 (Nov, 2017) Presence of different Met Centers in the world dedicated to Meteorology/Climate Ocean Sciences.*

Institute	Rmax Capacity	Top500 Rank	Total Capacity
JAMSTEC, Japan	19.1 PF	4	19.1 PF
UK Met Office, UK	7.0 PF, 2.8 PF, 2.8 PF	15, 46,47	12.6 PF
NCAR, USA	4.8 PF, 1.3 PF	24, 106	6.1 PF
ECMWF, Europe (UK)	3.9 PF, 3.9 PF	27,28	7.8 PF
KMA, Korea	2.4 PF, 2.4 PF	57,58	4.8 PF
Meteo France, France	2.2 PF, 2.2 PF	61,62	4.4 PF
NOAA, USA	1.6 PF, 1.6 PF	80,81	3.2 PF
Institute of Atmospheric Physics, China	1.1 PF	145	1.1 PF
Meteorological Research Institute, Japan	0.99 PF	185	0.99 PF
Chinese Institute of Meteorology, China	0.9 PF	256	0.9 PF
Indian Institute of Tropical Meteorology, MoES, India	0.7 PF &(0.35 PF at NCMRWF)	368	1.0 PF
NCEP, USA	0.7 PF, 0.7 PF	378,379	1.4 PF
Meteorological Services, China	0.6 PF	493	0.6 PF

Table 2: *Computational power of different Met Centers in the world countrywise (Source: Top500)*

Country	*Total Capacity*	*Ranks in Top500*
UK	20.4 PF	15,27,28,46,47,
Japan	20.0 PF	4, 185
USA	10.7 PF	24,80,81,106,378,379,
Korea	4.8 PF	57,58
France	4.4 PF	61,62
China	2.6 PF	145,256,493
India	1.0 PF	368