# Pratyush: India's fastest supercomputer for weather and climate prediction*

With an eye on improving weather and climate prediction in the country, India has recently upgraded its supercomputing capacity with the acquisition of a new high performance computing (HPC) system. The country's fastest and the first multi-petaflops supercomputer facility was inaugurated by Harsh Vardhan, Union Minister for Science and Technology, Earth Sciences, and Environment, Forest and Climate Change at the Indian Institute of Tropical Meteorology (IITM), Pune on 8 January 2018. As the Sun is the driving force for weather and climate systems on the Earth, the supercomputer is named 'Pratyush' (meaning the Sun in Sanskrit).


A view of the HPC Pratyush facility

Improving monsoon prediction has always been a top priority for the nation. Also, in the changing climate scenario, India needs reliable forecasts for extreme weather events like floods, droughts, tsunamis, cyclones, earthquakes, lightning, hot/cold waves, air quality, climate projections, advisories for fishing zones, etc.

In this direction, consistent efforts over several decades have resulted only in limited success. When statistical models have not been able to provide reliable operational forecasts at high resolution, dynamical models have shown better skill in forecasting rainfall with higher precision. Therefore, to meet the increasing demand for accurate prediction of monsoon rainfall, a dynamical prediction framework (based on the coupled Climate Forecast System from NCEP, USA) has already been developed for Indian conditions.

However, to run such dynamical models and to provide such forecast services, enhanced supercomputing power is necessary. Realizing its importance, the Ministry of Earth Sciences (MoES), Government of India is constantly working for augmenting HPC infrastructure at its constituent R&D institutions.

The HPC infrastructure at IITM has seen exponential increase in the last 10 years. IITM acquired its first HPC named 'Prithvi' in 2009 with 7.2 teraflops (TF) capacity, which was subsequently increased to 70 TF in 2010. Then in 2014, IITM acquired another supercomputer named 'Aaditya' with a computing speed of 790 TF. As these HPC systems generally have a lifespan of five years, they have to be augmented at regular intervals.

The newly acquired HPC facility, costing about Indian rupees 400 crores, has a combined peak computing capacity of 6.8 petaflops (PF). The facility is stationed at two locations: HPC Pratyush with 4.0 PF computing power at IITM, Pune and HPC Mihir with 2.8 PF computing power at National Centre for Medium Range Weather Forecasting (NCMRWF), Noida. HPC Mihir was inaugurated by Harsh Vardhan on 30 January 2018. While putting India at around the top-30 position (from the current 368th position) in the top 500 list of HPC facilities in the world, the facility will also place the country at the fourth position after Japan, UK and USA, with respect to dedicated HPC resources for weather and climate community.

In recent years, our improved dynamical forecast models, using the available supercomputing power, have provided better and reliable services for (1) predicting monsoon on different temporal and spatial scales, especially the seasonal and extended range predictions; (2) predicting cyclones like '*Phailin*', '*Hudhud*', and the recent '*Ockhi*' with adequate lead time; (3) predicting extreme rainfall events like the Uttarakhand floods, Kashmir floods, etc. and (4) providing tsunami warnings, and so on. Such reliable predictions have increased confidence on dynamical models run on supercomputers. Therefore, to provide precise prediction at very high resolution, more supercomputing power was needed.

Addressing the increased demand for more computing power, HPC Pratyush at IITM will serve as a national facility for improving weather and climate forecasts and services under the umbrella of institutions under MoES, which will be used by different MoES institutions, and other related research and academic institutions. HPC Mihir at NCMRWF will be used by select MoES institutions, mainly for daily operational forecasts.

These HPC facilities, especially HPC Pratyush will help generate improved understanding of weather and climate phenomena for providing better forecast services at very high resolution and at greater lead time, not only for India but also for the neighbouring countries. The facility will also contribute towards realizing the ambitious project for providing improved weather forecasts, including extreme weather events at block level over the country.

*Observations and views expressed here are personal.

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