

Preface



The year 2020 began with a lockdown! For the Institute the biggest challenge was to ensure continued upkeep and running of the high performance computing (HPC) system and make it available for COVID related simulations by computational biology and chemistry groups across CSIR. It was remarkable that we could continue to provide this crucial support under by far the most difficult situation faced by the Institute. Maintaining seismic network and the four GHG stations were also just as important. We rose to the occasion and ensured that our efforts in data collection, maintenance of important facilities and modeling activities continued uninterrupted.

While Covid disrupted our normal work, an opportunity came by when AMD, USA, contacted CSIR-4PI with a proposal to donate HPC platform exclusively for COVID research. It was a new situation not just for the Institute but also for CSIR as no such donation was ever received in the past. We pursued this and successfully signed off an agreement with AMD, USA and paved way for installation of HPC system rated at around 1.2 PetaFlops. Concurrently, we also received approval for refresh of existing HPC system aiming to provide 1 PetaFlops CPU compute and about 20 AI PetaFlops which should boost the research across CSIR. Third party evaluation mandated by Finance Commission was also completed in record time for this project.

The Institute continued to make significant strides in the core modeling areas. These are summarized below.

Ocean modeling efforts led to quantification of depletion of oxygen in the Arabian sea. The model established the roles of primary production in oxygen and remineralization and nitrification in its consumption. The extent of oxygen minimum zones were also well simulated. These are significant findings as ocean health is just as important in a connected eco-system. Green House Gas (GHG) measurements compliant with WMO standards showed that there is an increase of 2.5 ppm in the annual average from 2019 to 2020 which amounts to atmospheric loading of 5.3 Gigatonnes of Carbon in 2020. These findings have direct bearing on our aspiration to become Carbon neutral by 2030.

An MoU was signed with University of Kashmir and Indian Institute of Astrophysics for academic and scientific collaboration in the areas of seismic studies and GHG measurements. A major lab project was also sanctioned with a budget allocation of Rs 3.5 Crores to undertake seismic research in the Jammu, Kashmir and Ladakh region. Our focus remains on implications of crustal structure and crustal velocities on the seismic hazard of tectonically active northwest Himalayas.

In a major finding owing to integration for the first time the GNSS and broadband data it is clear that a major earthquake of 7.8 magnitude is overdue in this region. In another significant achievement, impact of GPS, Glonass and combined GPS & Glonass signals on the position and velocity estimates of Indian subcontinent was established and the same has been published.

As mentioned, we continued to provide uninterrupted access to HPC system to all the stakeholders which was particularly critical in the Covid times. Under the guidance of HPC Policy Committee of CSIR, it was decided to refresh existing HPC facility with focus on AI and ML which will impact our research activities in the future. A project with investment of Rs 50 Crores was cleared by CSIR HQ. During this time, we established procedure to provide robust AI based Covid cases prediction. We started providing weekly update to Government of Karnataka on the outlook of cases for Bangalore and the state. Our work on cybersecurity and cryptography continues to hold importance as two projects were amply supported by MeitY and DST under the Interdisciplinary Cyber Physical Systems (ICPS) mission of Gol.

Weather and climate research continue to play important activities of the Institute. The expertise in this area has also helped us provide inputs on the impact of weather on epidemiological diseases with emphasis on COVID. As regards to climate change, development of systems models have provided us with an ability to understand seasonal monsoon and climate under different aerosol scenarios, formulation of new algorithms.

Scientific output was significant as always. We published 29 articles and 22 projects are under progress.

CSIR-4PI remains small as of now with high impact in its traditional area of earth sciences research. Although small but significant steps have been taken to embrace the true spirit of the fourth paradigm, much remains to be done. The area of AI is progressing fast. It critically depends on well trained human resource with broad understanding in different scientific domains. The positioning of CSIR-4PI is truly central and as such needs to much attention in building up capability in the area of AI with focus on scientific research domains of CSIR. It is time to take that step.

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