INFORMATION SCIENCES CLUSTER

Scientific Excellence

Inter-decadal Trends in Acceleration of Accumulation of Atmospheric CO₂ during 1958-2008 based on Observations at Mauna Loa

Reanalysis of 51-year data set (1958-2008) of monthly mean atmospheric CO_2 derived from near-continuous observations at Mauna Loa (19°32' N, 155°35' W), Hawaii by CSIR-C-MMACS has revealed significant variations on decade-plus time scale in annual CO_2 accumulation rates. The rate nearly doubles from ~0.94 in the first phase (1958-1974) to ~1.79 ppm yr $^{-1}$ in the third phase (1992-2008). Linear and exponential trends of CO_2 accumulation rates averaged over a calendar year, or a running year, in a phase may be viewed as metrics of acceleration within the phase. These trends show a curious high-low-high pattern; for example, the first, second and third phase have respectively calendar year-based linear trends of 3.64, 0.39 and 2.86 % yr $^{-1}$ and exponential trends of 4.24, 0.24 and 3.73% yr $^{-1}$. Similar analysis of atmospheric CO_2 data from four other sites - Point Barrow, La Jolla, Christmas Island and South Pole-suggests that high-low-high acceleration of atmospheric CO_2 accumulation is a global pattern.

It is suggested that the period beginning with ~1974 marked by the first oil shock and ending with ~1991 by the end of the cold war had many geopolitical and geoeconomic uncertainties and four recessions in the United State of America. Subdued investments inhibited increase in industrial emissions and observed the low in acceleration of atmospheric CO₂ is the result.

Advance forecasting of Indian Summer Monsoon

Forecast of Date of Onset: Advance forecasting of the date of onset of the monsoon can significantly aid agricultural planning. However, worldwide, there has been little attempt at advance dynamical forecasting of the date of onset of the monsoon (DOM). A conceptual basis, and a dynamical platform involving the CSIR Global Circulation Model (adopted from LMD, France) were developed at C-MMACS for advance forecasting of DOM. This system has been put to test through experimental forecasts of DOM around April 15 of each year since 2007; the experimental forecasts are communicated to various users, including India Meteorological Department (IMD) for objective post-season validation.

The C-MMACS forecast of onset for 2011 was around 29th May 2011 according to the criteria of sustained, significant and large-scale rainfall in the model simulation. The announced DOM according to IMD was June 03, 2011.

Forecast of Monthly and Seasonal Anomalies: The forecasts of monthly anomalies are made with respect to the 25 year model mean for each member of a 5-member ensemble. The monthly and seasonal anomalies are expressed as percentage of the model (ensemble) mean.

The distribution of anomalies in seasonal rainfall of June, July and August (JJA) 2011 from NOAA CAMS Analysis (left panel) and C-MMACS long range forecasting (right panel) are presented in Figure 1.118

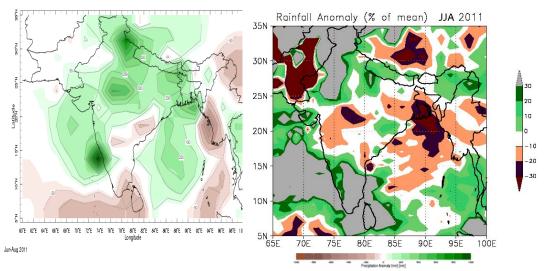


Fig. 1.119 Comparison of distribution of rainfall anomalies of (JJA) 2011 from NOAA analysis (left panel) and C-MMACS long range forecasting (right panel)

Comparison of spatial distribution of anomalies for June-August in C-MMACS forecasts and NOAA (National Oceanic and Atmospheric Administration) CAMS (Climate Anomaly Monitoring System) analysis for 2011 shows the two distributions to be in general agreement; in particular, both show excess over the west coast and deficit over the eastern coast. The C-MMACS forecasts are among the very few long-range high-resolution forecasts of monsoon.

Precision Agriculture through Weather Informatics

Typically, an episode of irrigation costs a marginal farmer (without own pump sets etc) about Rs 2500 [as per Karnataka State Natural Disaster Monitoring Centre KSNDMC]. The Hobli-level forecasts from C-MMACS helped farmers to avoid irrigation when rain is forecasted, at no risk. This has effectively added to their income. At larger scale, this has made agriculture more energy-efficient, with long term benefit to the country.

The forecasts have been now tested in operational conditions across Karnataka for more than two years. The statistical accuracy of the forecasts at Hobli level is around 75%. This implies, at the scientific level, that the basic hypotheses and the methodology of Hobli-level forecasting are validated. At the level of application, this is the first and sustained effort at hobli-level forecast with integrated outreach.

Exergy of scholarship

The impact factor is an estimated or projected performance rather than a received or realized performance. To assess the received or realized performance of CSIR, the actual citations received within the recent past has been computed by CSIR-NISCAIR. For this, all the papers (P) published by CSIR during a target window of five years (2007-2011) was taken. Then the total citations (C) obtained in the census year (chosen as the single year 2011) by all papers (P) is found. In effect, this implies

an impact i = C/P for the output of each unit for 2010. The performance of each institution is then obtained as $X = iC = i^2P = C^2/P$. The "exergy of scholarship" received in 2007 was 46573; and that of year 2011 is 112766 (Fig.1.121). This reflects an increase in impact/paper as well as an increase in total number of papers, i.e. an increase of 26% from 2010 to 2011. The X-index for the CSIR as a whole has been computed on the unique papers (Papers resulting from collaboration among laboratories are counted only once).

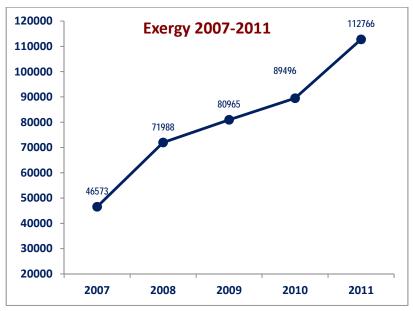


Fig. 1.120 Exergy of scholarship

Exergy of scholarship: CSIR and other leading Indian institutions

The papers published by the leading research institutions in the country over the five year target window and the citations gathered by these papers in the census window of a single year immediately following the target window were used by CSIR-NISCAIR to compute the impact i and the exergy X of scholarship. Next, i, C and X can be combined graphically into an iCX map which can then be displayed as a two dimensional contour map.

The progress over the five year rolling windows from 1999-2003 to 2005-2010 gives rise to very interesting trajectory patterns. It can be regarded as an impact-Citations-Exergy (iCX) landscape. The x-axis, represents the quantity of output and the y-axis, represents quality of output. Also, since E = iC, contour lines can easily be plotted on the map and these are shown by dotted lines for E = 100000, 50000 and 25000.

As performance is tracked over a five year rolling window from 2007 to 2011, an interesting dynamic picture appears. All institutions move up, metaphorically climbing a peak. Higher levels of performance are equated to having scaled higher heights of the quantity-quality landscape. Here, the emphasise has been given on the distinction between quality (i = C/P) and performance (X = $C/P \cdot C = iC$).

Figure 1.120 captures the relationship between quality and size in an iCX (impact-Citations-Exergy) Map.

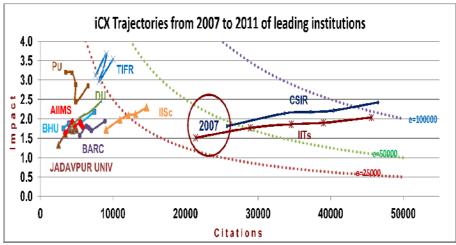


Fig.1.121 iCX trajectories during 2007-2011 of Leading Institutions of India

Recognition of CSIR-NISCAIR Journals

Indian Journal of Fibre & Textile Research (IJFTR) has been selected for inclusion in Thomson Reuters Web of Science. The Journal of Intellectual Property Rights (JIPR) has been assigned a rating of 6.6 by The National Academy of Agricultural Sciences (NAAS) in the year 2011. Both the journals are amongst 19 scholarly journals being published by CSIR-NISCAIR. Popular IP sites SiNApSE have posted links to JIPR webpage on their site. 14 articles from various issues of JIPR have been directly included for the course on Intellectual Property and its Management Agriculture offered by NBPGR, New Delhi of IARI (Deemed University). Some articles from JIPR has also been included in Jawahar Lal Nehru University M.Phil/ PhD.'s foundation course on IPR.

Books published

CSIR-NISCAIR has published two books entitled `Constructing Culture of Science: Communication of Science in India & China' and `Quality Education & Excellence in Science Research in Indian Universities'. These books were released by Prof. S.K. Sopory, Vice Chancellor, Jawaharlal Nehru University. The first book, a joint effort of India and China, narrates the story of Science communication in the two most populous and fastest emerging economies of the world. The second book presents a bird's eye view of the significant deliberations at the 98th Indian Science Congress held at Chennai in January, 2011. Some of the key issues contained in the book include: science policy agenda for the next five years; challenges of maintaining quality education; enhancing academia-industry interaction; challenging science issues on climate change; threat to fragile eco-systems, food and nutrition security etc.

Dissemination of information to S& T community

CSIR-NISCAIR provides communication links to scientific community through the publication of 19 scholarly journals of international repute, covering all major disciplines of science and technology. These 19 journals include 17 research and two abstracting journals. The research journals are (Volumes corresponding to years 2011-2012): Journal of Scientific and Industrial Research (JSIR, monthly, Vol. 70-71),

Indian Journal of Experimental Biology (IJEB, monthly, Vol. 49-50), Indian Journal of Biochemistry and Biophysics (IJBB, bimonthly, Vol. 48-49), Journal of Intellectual Property Rights (JIPR, bimonthly, Vol. 16-17), Indian Journal of Natural Products and Resources (IJNPR, quarterly, Vol. 2-3), Indian Journal of Marine Sciences (IJMS, bimonthly, Vol. 40-41), Indian Journal of Traditional Knowledge (IJTK, quarterly, Vol. 10-11), Indian Journal of Biotechnology (IJBT, quarterly, Vol.10-11), Bharatiya Vaigyanik evam Audyogik Anusandhan Patrika (BVAAP, Hindi, half-yearly, Vol. 19), Indian Journal of Chemistry - Section A (IJC-A, monthly, Vol. 50-51), Indian Journal of Chemistry - Section B (IJC-B, monthly, Vol. 50-51), Indian Journal of Pure and Applied Physics (IJPAP, monthly,' Vol. 49-50), Indian Journal of Radio and Space Physics (IJRSP, bimonthly, Vol. 40-41), Indian Journal of Chemical Technology (IJCT, bimonthly, Vol. 18-19), Indian Journal of Engineering and Materials Sciences (IJEMS, bimonthly, Vol. 18-19), Indian Journal of Fibre and Textile Research (IJFTR, quarterly, Vol. 36-37), Annals of Library and Information Sciences (ALIS, quarterly, Vol. 58-59). The abstracting journals are: Medicinal and Aromatic Plants Abstracts (MAPA, bimonthly, Vol. 33-34), and Indian Science Abstracts (ISA, fortnightly, Vol. 47-48).

All the CSIR-NISCAIR journals follow international practices for scholarly communication, e.g. having editorial boards, peer reviewing in case of research journals, and timeliness, and are covered by the major abstracting, indexing and current awareness services in their respective fields. Many are also covered by SCI, e.g. IJC-A (2011, IF 0.891), IJEB (2011, IF 1.295), IJCT (2011, IF 0.606), IJBB (2011, IF 1.142), IJC-B (2011, IF 0.648), IJC-A(2011, IF 0.891), IJPAP(2011, IF 0.763) etc.

Special issues of the journals are brought out from time to time on important themes. Some of the journals are celebrating their 50th year of publication like IJEB, IJC-A, and IJPAP. The themes of special issues of the various journals brought out during 2011-12 are: Advances in Biomedical Sciences (IJBB, Vol 48, No. 4, August, 2011); Water Management, Biomass Production and Sustainable Energy Systems for Rural Development (JSIR, Volume 70, No. 8, August, 2011); Bioinorganic Chemistry (IJC-A, Volume 50A, No. 3-4, April, 2011), Perspective & Challenges(IJCA, Volume 51A, No. 1-2, Jan-Feb 2012) etc.

Science popularization

CSIR-NISCAIR endeavours to take science to the people, mainly students, through its well-circulated three popular science magazines: Science Reporter (English monthly); Vigyan Pragati (Hindi monthly); and Science Ki Duniya (Urdu quarterly).

Science Reporter (Vol 48-49) continued with its objective of providing to its readers topical coverage of issues in various fields such as information technology, wildlife, environment, space, nuclear technology, health and biotechnology as well as informative reading material such as amazing scientific facts, profiles of scientists, science projects, inventions and discoveries and much more.

Likewise, Vigyan Pragati (Vol. 60-61) continued to provide information in an easy to understand mode on important current events/issues.

Similarly, Science Ki Duniya (Vol 37-38) continued to provide a package of interesting columns such as Science Quiz, Science Models, Science News, Science for Children and Science for Women apart from major articles covering a wide range of fields including agriculture, energy, environment, food, health care, oceanography, space and wildlife.

CSIR-NISCAIR also brings out the Council's newsletter CSIR News (fortnightly, Vol 61-62 during the reporting period) that serves as a useful link among the various CSIR establishments and also communicates activities/accomplishments of the Council, particularly those pertaining to research and developments, to other R&D organizations, universities, S&T agencies/ departments, industry and other users, mass media, etc. It also disseminates information regarding CSIR to other countries through Indian/foreign missions. Its Hindi version, CSIR Samachar (monthly, Vol 28-29) is also brought out. Full text of both the newsletters is regularly uploaded on the websites of CSIR-NISCAIR and CSIR.

India, Science and Technology, 2010-11

CSIR-NISTADS has brought out India S&T Report 2010-11. Innovation, which forms the base for current global economy, is the core concept of this report. The report has identified: the nature and extent of innovative activities in the country; the lacunae in the innovation support mechanism; and S&T interventions required in the policy matrix to enable India to be in the forefront on innovation activities. India S&T Report 2010-11 is organized under following five themes: (i) S&T and Human Resources; (ii) S&T and Innovation Support System; (iii) S&T and Industry; (iv) S&T Outputs and Patents; and (v) S&T and Rural Development Strategies. While the content and approach of these five themes differ from each other, innovation occupies the central stage in each of these themes. The report is targeted at a wide readership ranging from policy makers and advisors to academic readers as well as the common person.

'Strategic Thinking' Book by CSIR-NISTADS

The book brought out by CSIR-NISTADS through Sage Publications provides an interpretation of strategy around an 'actor' rather than an organization. It views strategic action as being executed in a 'milieu' populated by power holders, where the individual strategist actor holds centre stage, and where pursuits are obstructed by the countervailing threats of other power holders. The authors explain that the strategic 'milieu' is an intensely governed set-up where the relations and transactions between the power holders controlling key assets are under the governance of the current set of rules and institutions. The book shows how one can appreciate several contemporary business practices, especially under 'increasing returns', by focusing on the relation between the 'economics' and the 'governance' of an asset. Cooperation, as opposed to deterrence, informs such strategic acts under increasing returns.

'Agro-biodiversity Conservation in Indian Central Himalaya: On Farm (*Insitu*) Practices' Book by CSIR-NISTADS

CSIR-NISTADS, through this book, discusses the loss of agro-biodiversity is threatening the food security and livelihood of smallholding poor farmers. The real worth of agro-biodiversity cannot be realized by the farming community unless such bio-wealth is converted into income-generating enterprises by identifying and adding value. Agricultural biodiversity can only be saved if the country's path of development undergoes fundamental changes. Unless the new economic policies and the proposed changes in legal regimes governing agriculture are challenged with united action and alternative visions, concerns related to biodiversity, sustainability, and equity will remain subordinated to the lure of profit.

'Gender and Science: Studies across Cultures'-Foundation Books, Cambridge University Press, India, 2012

The book brought out by CSIR-NISTADS covers data and findings across a few nations and reveals universal as well as a few diverse facts, such as vertical and horizontal gender segregation and a dramatic increase in the number of women getting into engineering in some nations. The fields of science, technology, engineering, and mathematics drive economies worldwide. The under representation of women at the highest levels of science, technology, mathematics, and engineering is a matter of concern in the era of knowledge-based economies. The book deals with the social, economic, political, socio-cultural and socio-psychological barriers to explain why science and technology remain 'gendered', transcending time and geo-cultural locations.

Unique Major Facilities

High Performance Computing

The High Performance Computing (HPC) system at CSIR C-MMACS is the largest computational facility in CSIR and also one of the leading facilities in the country. This is the backbone of computational research in various fields of interest to CSIR. The current fastest system at CSIR C-MMACS is the Altix ICE cluster system with 2304 numbers (after up gradation in January 2012) of processing cores distributed over 192 nodes interconnected in the form of an enhanced hypercube using the QDR

(32Gbps) infiniband communication medium. The system currently is listed as the 8th largest (December 2011 list) in the country and is equipped with Intel Westmere-EP Hex core processors running at 2.93/3.06 GHz frequency. Each node has 12 processing cores with 24 GB of memory in a shared memory form, while the system as a whole has 4608 GB of memory across the 192 nodes in a distributed architecture. The peak performance that the system can



Fig.1.122 HPC system Altix ICE 8400

achieve is 27 TFLOPS, while it has one of the best percentages of sustained performance (of about 23 TFLOPS), which is more than 85% of the peak in High Performance LINPACK (HPL).

A luster parallel file system of 30TB handles the storage requirements for the computing system. The system is being used by a large number of CSIR laboratories through secure remote connectivity powered by 1 Gbps National Knowledge Network. Figure 8 presents the usage statistics of different laboratories with respect to time, number of CPUs and also usage of memory.