Climate for You

The Quarterly Newsletter of ICCSIR
January 2009 Volume 2 Issue 1

Editorial:
Mahashweta Agarwal

I Wish you a very happy 2009!

*I am very pleased to put this 2nd issue of **Climate for You** in your hands after an overwhelming response to the inaugural issue in October 2008.*

*In this issue, we cover topics as wide-ranging as reconstruction of past climate, its connection with the current one, and the requirement of more data for future prediction; climate variability in Antarctica; and decadal climate variability. On the societal impacts front, an article outlines the necessity of having a drought monitoring and early warning system in Western India so as to allow stakeholders and policymakers to understand the physical aspects of droughts as well as their social, economic, and environmental impacts. We hope that these articles will initiate vigorous discussions and future programs. As suggested by Dr. G.B. Pant in his article**, Climate for You** is a part of our New Year resolution to generate societal awareness about all aspects of climate and its societal impacts.*

*As a part of ICCSIR's education initiative, we have started a monthly seminar series and we will be reporting about it in **Climate for You**, beginning with this issue. We are also planning to organize a summer school for university and college teachers this year.*

*We would like to thank the Shroff Family Charitable Trust for giving us a grant for ICCSIR's activities. We thank all contributors for their articles and their untiring support in bringing out **Climate for You**. We always eagerly await your feedback about the newsletter for further improvement in its quality, and will be happy to include very brief contributions containing comments on published articles. We will also be happy to post your comments on www.iccsir.org.*

Contents:

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Resolution 2009

Dr. G.B. Pant
Director (Retired) & Honorary Fellow,
Indian Institute of Tropical Meteorology, Pune

I very sincerely wish a happy and prosperous new year to all the readers of "Climate for You"; however, I hesitatingly refrain from extending a warm welcome to the year 2009. Let not the year 2009 join the list of top warm years of modern industrial era. I prayed for a cool, clean and clear view of the rising sun on the early morning of January 1st 2009. I also wished for persistence of this pleasantness throughout the year. I did this not because I have a significant record of my wishes being successfully fulfilled in the past, but because of my genuine concern regarding global warming. In the Indian context, except for the sporadic statements from individuals, award of Nobel peace prize to the climate panel (IPCC) and occasional repeat articles and news items from international media, the subject of climate change and its impact have been a non-issue. I am sure, not a single soul who matters or influences the public opinion would have thought of a New Year resolution dedicated to the cause of the planet we live in. It is quite likely that a few amongst us might have contributed by coincidence to the resolve, such as *quit smoking* because it is injurious to health, *eat no meat* as a token of mercy, *conserve energy* to beat inflation, *walk a few miles* to cut fat or *plant a few trees* in our courtyard to match the neighborhood effort and so on.

The pattern of the common man's behavior in a developing society is quite understandable as in the midst of their newly acquired consumerist avatar they have very limited information to link their actions to the environment around them. Even if they have some knowledge, the immediate gains overshadow the long term impacts. These issues acquire the lowest priority due to the lack of proper education and inspiration from the enlightened section of society. A small section of the public comprising of educated and well informed individuals should be made to comprehend the gravity of the situation; they can then carry the message down to the grass root level. The efforts required maybe enormous and challenging but could have a deep impact.

It is well known to the scientific community that the changing climate as experienced by all living and non-living species including human beings evolve out of complex non-linear processes and interactions among its components. The climate therefore has as many definitions as their interpretations. When we talk of its impact in specific terms of warm or cold episodes, extremes of droughts and floods, intense and heavy rain spells, changing intensity and frequency of cyclones and such other climate/weather related events; we end up recounting the agonies of the immediate past. The task becomes much more difficult when we attempt to predict these events and create scenarios of the future in various time and space domains. Recent analyses and studies based on long term global data from observations and model simulations have given enormous material to scientists for further studies. In the meantime, they have given enough *masala* to the doomsday protagonist, juicy paragraphs from negotiation tables to media and ample scope to some for quick publicity while the sun shines brighter.

Let us resolve to do more - put the facts across the table, start educating the masses and work on an awareness campaign.

What do they call the main conference room at The Weather Channel?
The Topical Convergence Zone.

How come it never rains inside a barn?
It's a stable atmosphere.

Climate and Environmental Signals in Antarctica

Prof. Prem Chand Pandey
Professor, Centre for Oceans Rivers Atmosphere and Land Sciences (CORAL), IIT Kharagpur & Former Founder Director, NCAOR, GOA.

India has been engaged in Antarctic science since 1981, with the launch of the first Indian Antarctic Expedition with Dr S.Z. Qasim as its leader. The establishment of the National Centre for Antarctic and Ocean Research (NCAOR) at Goa in 1998 has added new dimension in Antarctic science, specially the establishment of National Ice core facility for paleoclimate research from ice cores of Antarctica and marine sediments from the southern ocean.

Figure 1: Geographical map of Antarctica showing Maitri station of India
(Source- internet)

Antarctica continent is unique in many respects covering an area of about 14 million sq. kilometers with ice thickness of about 2.6kms, in addition to being the driest, coldest and windiest place on the earth. The ice core contains the information about the past climate change which is obtained by studying oxygen isotope ratio with a mass spectrometer. There are global and national programmes of ice coring in Antarctica where ice core of about 3.5 kms has been obtained from Vostok. India has been coring around Maitri station and has been successful in coring upto a depth of ~200meters. The longer ice cores give climate information upto ~400,000years and the shallow ice core upto few thousands of years. The bubbles trapped in the ice cores gives information about the past green house gases such as CO_2, methane and dust. The Vostok ice core has given the variation of methane, CO_2, dust and temperature which has close correspondence. Figure 2 illustrates the variation of temperature, CO_2 and dust as obtained from the analysis of ice core data.

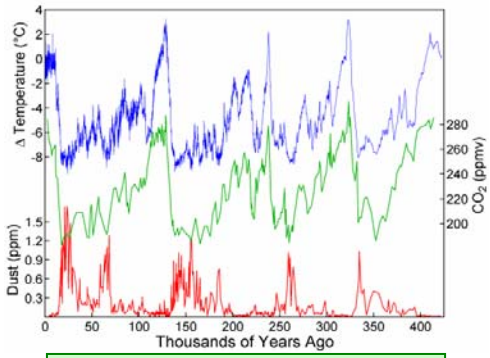

Figure 2: Variation of temperature, CO_2 and dust
(Source- internet)

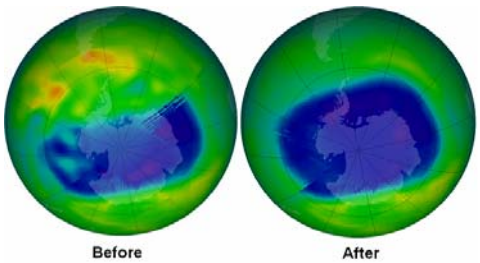

Figure 3: Position of Ozone hole before and after the ozone loss
(Source- internet)

In addition, Antarctica is also a sensitive indicator of environment changes. We all are familiar with Ozone hole phenomenon over Antarctica which is due to catalytic destruction of Ozone molecule primarily with ClO and BrO obtained from halogen compounds which are transported to the poles through the phenomenon of Hadley, Ferrel and Polar circulations. The monitoring of the ozone hole is being carried out by many nations around Antarctica by ground based equipment and also by satellites. The accompanying figure 3 shows the position of Ozone hole before and after the ozone loss as obtained by satellites.

Antarctica and the Arctic are integral components of the planet earth and the study of polar regions has gained more importance now than ever before due to problems of global climate

change. Polar regions provide unique laboratory for many scientific studies ranging from microscope to macroscope and has drawn the attention of 48 nations which constitutes the 80% of world populations for polar research. International polar year (2007-2009) is an example of international co-corporation in polar research due to complex and costly logistics. India is playing an active role in all international efforts related to polar science and is a member of scientific committee on Antarctic Research (SCAR).

The Atmospheric Circulation Reconstructions over the Earth (ACRE) Initiative

Dr Rob Allan
ACRE Project Manager, Climate Monitoring and Attribution Group, Met Office Hadley Centre, Exeter, Devon, United Kingdom.

The Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative (http://www.met-acre.org/) is led by a consortium of the Queensland Climate Change Centre of Excellence (QCCCE) in Australia, the Met Office Hadley Centre in the UK, the Cooperative Institute for Research in Environmental Sciences (CIRES) Climate Diagnostics Centre at the University of Colorado, and the US National Oceanic and Atmospheric Administration (NOAA).

ACRE facilitates and forges effective linkages between:

1. the international recovery, imaging, digitisation and archiving of terrestrial and marine daily to sub-daily historical global weather observational data
2. the assimilation of these observational data in pioneering surface-input-only historical reanalyses of global 4D weather
3. the provision of the 4D global gridded historical weather variables produced by these reanalyses to climate research, applications & impacts communities, especially for their use in global to regional/local physical, biophysical and production models.

The historical data component of ACRE builds on earlier undertakings, such as the EU-funded CLIWOC (CLImatological database for the World's OCeans 1750-1850) project (http://www.ucm.es/info/cliwoc/) which looked primarily at non-instrumental weather observations in ship logbooks from the old European colonial powers. Ship logbooks and various marine registers are a vast and valuable source of data that has been scarcely examined.

ACRE works closely with the international surface weather observations community, linking with the international RECLAIM (RECovery of Logbooks And International Marine data) (http://icoads.noaa.gov/reclaim/), International Surface Pressure Databank (ISPD) and International Comprehensive Ocean-Atmosphere Data Set (ICOADS) (http://icoads.noaa.gov/) projects, plus the CLIWOC participants, and various UK academics and archives, to expand the recovery, imaging and digitisation of historical instrumental weather observations in terrestrial registers and marine logbooks held in various UK repositories (e.g. The British Library, the Met Office Archives and the National Archives). However, these activities require considerable time and resources. Even working

closely with US digitisers from the specialist NOAA Climate Data Modernisation Program (CDMP) (http://www.ncdc.noaa.gov/oa/climate/cdmp), a Met Office project to image and digitise records to fill the World War 2 coverage of surface marine weather observations has taken 2 years.

All of these data activities will improve the quality and quantity of global historical surface weather observations, and thus facilitate the data requirements for the production of three historical global 4D weather reanalyses led by its US partners over the next 5 or so years. These are:

1. 20th Century Reanalysis Project (1891-present; due for release in mid-2009),
2. Surface Input Reanalysis for Climate Applications (SIRCA) (1840s-2011),
3. North Atlantic-European Region mid 18th-early 19th Century to the present Reanalysis.

These reanalyses will produce dynamically consistent reconstructions of tropospheric and stratospheric 4D global weather conditions using state-of-the-art scientific capabilities. The 4D weather variables will be generated on a global grid every 6 hours (initially at 2 degree latitude by longitude resolution) just from the surface observations of synoptic atmospheric pressure, plus monthly sea surface temperature and sea-ice data.

For climate applications and impacts needs, these reanalyses will provide a unique long-term global weather database which can be tailored or 'downscaled' to finer resolution for output to the climate research, applications and impacts communities and outreach to the wider general public and educational communities. As output, they can be fed directly and seamlessly into various biophysical, ecological, environmental, production etc models which need high quality, high resolution gridded weather data input. Enhanced visualisation and access to the raw weather observations, meta data, data sources, original images right though to the historical reanalyses themselves, are being developed in conjunction with Google. Some basic samples building towards this potential can be found at the Old Weather website linked to ACRE (http://www.oldweather.org/).

The historical reanalyses data base thus provides the full spectrum of users with a baseline with which they can assess, and reassess, the impacts of past climatic variability, putting them in a much stronger position to look into the future at possible implications and impacts of climate change. The full global range of collaborations, linkages, projects and proposals involved in the international ACRE initiative to date, can be seen at the following website: http://sites.google.com/a/met-acre.org/acre/international-acre-partners--collaborations---linkages-1

Hurricane Michelle and El Niño are having a drink in a bar. 'I'm so tough' boasts Michelle, 'I can devastate entire island economies and cause multimillion dollar damage to the eastern seaboard'. 'That's nada' dismisses El Niño. 'I can cause flooding in deserts, the desiccation of rainforests. Entire ecosystems thrive or die at my mere whim. The economies of nations are subject to my vacillations'. Upon which a small north Atlantic low pressure system enters the bar, precipitating meekly on the floor. Hurricane Michelle and El Niño dive for cover behind the bar, trembling. 'What's up with you?' jeers the barman, 'I thought you two were the toughest meteorological phenomena in town!' 'We're tough' wails El Niño, piteously, 'but he's cyclonic!'

- Josh Phillips

A Drought Monitoring and Early Warning System for Western India

Dr. Cody L. Knutson
Leader, Planning and Social Science Program,
National Drought Mitigation Center, USA

A drought monitoring and early warning system provides the foundation for effective drought mitigation and response. A good monitoring system will allow planners to gather and analyze data to better understand the physical aspects of drought (e.g. frequency, severity, duration, and spatial extent), as well as it's social, economic, and environmental impacts. This information allows planners to target actions towards the regions, populations, and activities most at risk. With this understanding, and the inclusion of appropriate weather and climate forecasts, an early warning system can then be developed, which will help communicate threats and direct decision makers in implementing proactive management actions prior to and during drought events.

Drought monitoring is not a new concept in India. J.S. Samra in "Review and analysis of drought monitoring, declaration and management in India" in International Water Management Institute working paper 2004 (http://www.iwmi.cgiar.org/droughtassessment/files/pdf/WP%2084.pdf), describes monitoring processes at both the state and federal level in India. He points out that, although India has a system of drought monitoring, early warning, and impact analysis, there are areas for improvement. For example, drought monitoring and management activities vary by state, and are often seen as ad-hoc in nature instead of a regular and institutionalized part of program activities. Current impact and loss estimations also lack robustness since they focus primarily on annual crop losses at the expense of perennial crop, orchard, tree, livestock fertility, wildlife, biodiversity, and other non-farm ripple effects. Regional monsoon forecasts were also criticized for not being site- and time-specific enough for effective local application. In general, the systematic use of modern tools and procedures of monitoring, automatic triggering, impact analysis, documentation, and capacity building were viewed as inadequate. The report suggested that India build upon its existing system by enhancing capacities to develop more systematic and robust procedures for monitoring drought using the latest technologies and processes.

With this in mind, it would seem prudent that new advancements in drought monitoring and early warning be used to supplement and enhance systems and procedures already in place in Western India. This could include implementing standardized monitoring and impact assessment procedures that help remove some of the politics from declaring drought. Monitoring systems would utilize the best available technologies to measure and relay a variety of physical and social drought indicators on a continuous basis and in a timely manner. Where possible, this would include the use of automated and real-time measurement and communication technologies, including tools such as remote sensing. Field observers and manual measurements can also be used to supplement and validate this type of information at the local scale. There are many examples of drought monitoring systems around the world that could be examined for their applicability in Western India, including the U.S. Drought Monitor (http://drought.unl.edu/dm/monitor.html)

As drought-related information is being gathered, it should be systematically archived in databases to assist in the analysis of vulnerable regions and sectors using geographic information systems and other analysis tools. This refers not only to the collection and analysis of meteorological data but also the social, economic, and environmental impacts of drought, which are often not systematically gathered or archived. With a better understanding of drought occurrence and local vulnerabilities, and the inclusion of enhanced short- and long-term forecasts, more effective and better targeted early warning systems can

be developed in Western India. This type of warning system would include specific triggering thresholds, which will assist in determining drought severity and implementing proactive mitigation and response actions to limit the devastating impacts that are often inflicted upon people, their livelihoods, and the local environment that sustains them.

Introduction to Decadal Climate Variability

Vikram M. Mehta
Director, Indian Centre for Climate and Societal Impacts Research, Ahmedabad

What causes decadal climate variability?
Numerous causes of decadal climate variability have been hypothesized. At the center of many of them is natural variability in ocean circulations and ocean waves bouncing between continental boundaries, and their interactions with the atmosphere. Also, radiation from the Sun undergoes near-cyclic variability at 11 and 22 year periods, setting off reactions in different parts of the Earth's systems - atmosphere, oceans, ice, land and vegetation. Each system reacts at its characteristic speed, atmosphere adjusting in days to weeks, and oceans over months to centuries.

Research on decadal climate variability (DCV) dates back to at least the 19th century, perhaps to as far back as when sunspots were first seen to vary in number, size and location on the Sun. One anecdote suggests that Meton of Athens, an engineer in charge of the Athenian irrigation system, speculated in 400 B.C. about solar variability as the cause of rainfall variability in and around Athens.

Observers have identified solar cycles of roughly 11 and 22 years, and fluctuations in lunar tidal strength of 18.6 years, as well as lower harmonics of these cycles. Because of the hypothesized influence of the 11 and 22 year solar cycles and the 18.6-year lunar cycle on earth's climate, early researchers invoked the phrase "decadal climate variability" to describe climate "cycles" with 10 to 20 year repeat intervals.

Figure 1 shows perhaps the oldest definition of decadal climate patterns based on the 11 year sunspot cycle, dating back to at least Renaissance times. This particular example is of sea-surface temperature (SST) anomalies in the tropical Pacific, overlaid with solar radiation fluctuations. They appear to be in synch during the 1960s and 1970s, but move out of phase in the 1980s and 1990s. Such phase shifts are why solar and lunar explanations fell out of favor around the mid 20th century.

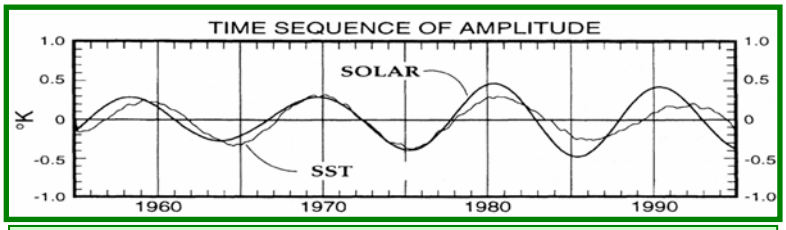

Figure 1: Overlaying solar radiation fluctuations with changes in sea surface temperatures in the second half of the 20th century suggests that a much longer record would be needed to draw a meaningful conclusion about whether the two are normally in or out of phase.

Another way to define a climate variation lasting approximately a decade is from the duration of "bursts" or groups of more frequent phenomena, such as El Niño- La Niña events, hurricanes and other tropical cyclones, extreme precipitation or heat. The example shown in Figure 2 (below) depicts the so-called Niño3 SST index, a measure of the El Niño- La Niña variability in the tropical Pacific. In this time series, there are two bursts of El Niño events

(red) from mid-1890s to 1905 or so, and from the mid-1970s to the late-1990s. There is also one burst of La Niña events (blue) from approximately the early 1940s to the late 1950s. Each of these bursts lasts approximately 10-20 years.

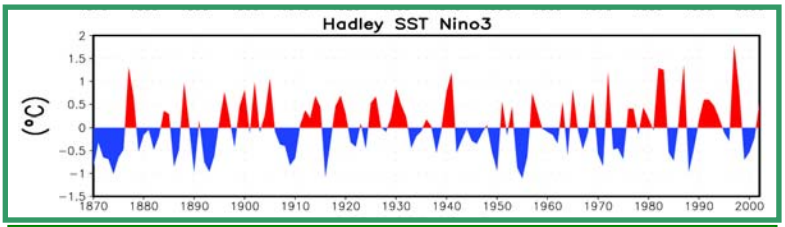

Figure 2: This figure shows the "Niño 3 Sea Surface Temperature Index," with El Niño, higher temperatures, in red, and La Niña, lower temperatures, in blue. It shows two El Niño bursts, one from the mid-1890s to 1905 and another from the mid-1970s to the late 1990s, and one La Niña burst from the early 1940s to the late 1950s.

History is full of pivotal events related to climate -- precipitation, surface temperature, river flow, droughts, and floods that have affected the course of civilizations. Persistent droughts (i.e., early 1900s, mid-1960s to early 1970s, 1980s, and late 1990s- to early 2000s) and floods (i.e., 1880s-1890s, 1930s-1940s-1950s, and recent years) in India were associated with DCV phenomena. Decade-long droughts in the North American Great Plains led to out-migration of people, especially in the 1890s, 1930s, 1950s, 1980s, and years since 2001-02. Northwestern United States experiences decadal climate variation in precipitation, stream flow, fish catch, and forest fires, and the Southwestern United States and Mexico, in precipitation. Socio-economic-political instability in the Nordeste region of Brazil is linked to multiyear to decadal droughts. The suffering caused by the Sahelian droughts in the 1970s-1980s-1990s is well-known. Long-term variability in numbers of hurricanes and other tropical cyclones in the Atlantic, Pacific, and Indian Oceans is also well-known.

Scientists hope that by arriving at a better understanding of the cycles of the Earth's many subsystems, they will be able to provide more reliable forecasts of precipitation, temperature, and other climate events a season, a decade or longer in advance. Such information could be used to anticipate food shortages, avoid crop losses, protect habitats and reduce suffering and mortality.

Contributors to decadal climate variability:

- Ocean-atmosphere interactions
- 11- and 22-year solar cycles
- 18.6-year lunar tidal cycles and their lower harmonics

Subsequent articles in this series will describe major DCV phenomena, their known societal impacts, and DCV forecast efforts.

Surprising Result of Global Warming

Ruined Ruins: *All over the globe, temples, ancient settlements and other artifacts stand as monuments to civilizations past that until now have withstood the tests of time. But the immediate effects of global warming may finally do them in. Rising seas and more extreme weather have the potential to damage irreplaceable sites. Floods attributed to global warming have already damaged a 600-year-old site, Sukhothai, which was once the capital of a Thai kingdom.*

Seminars

Mahashweta Agarwal
Outreach Specialist, ICCSIR

ICCSIR has started a seminar series targeting scientists, researchers, university and college, professors and students. The purpose of starting such a seminar series is that people from all these genre get informed and educated about the latest developments in the Earth System Sciences (ESS) and its societal impacts. The seminar will be held every month on a particular subject by an invited expert in the field.

The first seminar of the series was held on 15th November '08 by *Dr. Vikram M. Mehta*, *Director ICCSIR and executive director CRCES* on "Decadal Variability of the Indo-Pacific Warm Pool and Its Association with Atmospheric and Oceanic Variability in the NCEP–NCAR and SODA Reanalyses". In his seminar Dr. Mehta described work done to study decadal variability of Indo-Pacific Warm Pool (IPWP) Sea Surface Temperature (SST) and its association with atmospheric and oceanic circulations. The major results include (1) surface area undergoes significant decadal-multi-decadal variability, (2) decadal changes extend deeper to 300m, (3) atmospheric circulations exhibit thermally-direct response to decadal IPWP SST variability by altering Hadley and Walker circulation. The observations are in general agreement with general circulation model simulations.

The next seminar of the series was held on 19th December '08 by *Prof. J.N. Desai, Former professor Physical Research Laboratory (PRL)*, on "Light Scattering: Applications to Aerosols". In his talk Prof. Desai explained about Rayleigh's quantitative explanation about the main characteristics of light scattered by small particles as the radiation of an oscillating electric dipole induced by electromagnetic field of incident light. Prof. Desai also explained about the Mie solution, when the particles were rather large compared to the wavelength.

Announcement for Summer School 2009

With an aim to give an exposure and encouragement to college and university teachers and post-graduate students to take up research careers in Earth System Science (ESS), ICCSIR plans to conduct a summer school of 2 weeks on ESS. The tentative dates are May 25-June 10 2009. *Prof. K. M. Kulkarni (Head, Department of Geography, Gujarat University, Ahmedabad)* is the convener of the school, and *Dr. Ami Rawal (Geography Department, M.S. University, Vadodara)* and *Dr. D.B. Vaidya (ICCSIR, Ahmedabad)* are the co-conveners. In this course, we also plan to provide an introduction to climate data analysis and climate models. The course faculty will consist of eminent scientists from premier research institutes, university departments and ICCSIR staff members. The number of participants will be restricted to total 35 (25 Science college/university teachers and 10 post- graduate/ Ph.D. students).

We invite applications for the summer school. The applications should include educational and professional qualifications, research experience (if any), and complete contact details including email address and phone number. The last date for application is 20th February '09. The applications can be sent by email to Mahashweta Agarwal/Yashesh Vyas on outreach@iccsir.org or by post to Yashesh Vyas (Office Manager) at the following address:
Indian Centre for Climate and Societal Impacts Research
Ahmedabad Education Society Compound
Near Commerce College Six roads, Navrangpura, Ahmedabad- 380009

Newsletter Feedback

I have perused the Newsletter and must confess that I am greatly impressed by its scope and style of presentation. I extend my heartfelt congratulations to you and your editorial team for bringing out such a significant publication.

Prof Samir K. Bramachari (Director General, CSIR and Secretary, Department of Scientific and Industrial Research)

I congratulate the team ICCSIR and Dr. Vikram Mehta in releasing this news letter, first of its kind in India. Wishing you all the best to achieve all your goals and objectives.

Dr. Srinivasa Rao Gattineni (Crop & Weather Intelligence Group, National Collateral Management Services Limited, Hyderabad)

I congratulate you on your initiative.

Prof. M. S. Swaminathan (Member of Parliament (Rajya Sabha), Chairman, M. S. Swaminathan Research Foundation, Chennai)

I am delighted to receive the newsletter of ICCSIR which is an important initiative from Vikram Mehta. The Editorial is excellent and the articles are well written for many to appreciate the usefulness of climate research.

Prof P.C. Pandey (Emeritus Professor, Centre for Oceans, Rivers, Atmosphere and Land Sciences, Indian Institute of Technology, Kharagpur)

Media Coverage:

ICCSIR will research climate impact, ensure that it reaches agencies concerned and the common man

Now, a local body to study climate change

DNA Correspondent

Close on the heels of several global agencies attempting to understand the impact of climate change on human life and society, Indian Centre for Climate and Societal Impacts Research (ICCSIR) has been recently established in Ahmedabad to study the science of climate evolution and societal adaptation for socioeconomic and political stability.

ICCSIR is a non-profit organisation formed as a public-private partnership.

With a tie-up with the Space Applications Centre (SAC) on the radar, ICCSIR differentiates itself from the plethora of such agencies with a focus on not only conducting research into the area of climate impact, but also ensuring that it reaches concerned agencies and the common man, to make a difference to his life.

The results of ICCSIR's research will be provided to farmers to help them in planning their crops, urban planner's to help them in civic planning and land-use patterns, and to the common man to aid in social awareness on the environment. This will be done through symposiums, conferences, online campaigns etc.

ENSURING A FUTURE

"To begin with, the research will be western region-centric and will eventually reach out to the entire country. We will look at evaluating the local impact of global climate issues. We hope to eventually upgrade our website to give real-time data of rainfall," said Vikram Mehta, director of ICCSIR. The Institute has begun talks with the government of Gujarat and the urban and water departments on sharing of data of the research, and to conduct studies required for better planning of resources.

"ICCSIR will later study the economic impact of climate change," said Mehta. Dr Vijay K Agarwal, director of the meteorology and oceanography group at SAC; Nasa researcher Dr Anita Mehta and former physics professor at Gujarat College, Deepak Vaidya have joined the institute as researchers.

The collaboration with the Indian Space Research Organisation (Isro) is being finalised, said Mehta, adding that collaborations with agencies the UK and the National Drought Mitigation Center in Nebraska, US, are also under consideration. A tie-up with the Anand Agricultural University is also in the pipeline.

ICCSIR director Vikram Mehta at the institute's office in Navrangpura –Bhavel Bhanwad/DNA

Future impact

The results of ICCSIR's research will be given to farmers to help in planning crops, to urban planners for use in civic planning and land-use patterns, and to the common man to enhance awareness on the environment

Article about ICCSIR in DNA (Ahmedabad) on 6th December 2008

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