INDIAN METEOROLOGICAL SOCIETY

AHMEDABAD CHAPTER

Issue: Jan-Mar *MEGHA* 2012

World Meteorological Day Issue

Contents

Megha – Editorial Board (2011-2013)

From IMS-AC Chairman's Desk

A S Kiran Kumar

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It gives me an immense pleasure in wishing members of the Indian Meteorological Society – Ahmedabad Chapter (IMS-AC), through this special issue of MEGHA, on the occasion of the World Meteorological Day, being celebrated worldwide on the 23rd of March. "Powering our future with Weather, Climate and Water", a rightly chosen theme by the World Meteorological Organization (WMO) in the current scenario, underpins the need for Weather and Climate-driven information to be effectively assimilated into all future resource management and allied services. In fact, this calls for a rethink for a more meaningful collaboration among the Scientific & Management communities working on Environmental Issues and various stakeholders.

I am happy to see that this special issue of MEGHA has a diverse mix of theme-relevant contents that will enthuse its readers. I am glad that the Editorial Board of MEGHA has taken all pains to have Messages from IMS-National Council Chairman, Dr. Shailesh Nayak and an Interview with Dr. R. R. Navalgund, Director SAC, besides an important message excerpt from WMO Secretary-General, thus providing various thought-provoking ideas to the readers of MEGHA from persons who have remained associated with environmental issues throughout their career.

At the close of my message, I once again wish members of the IMS-AC a very happy and stimulating World Meteorological Day-2012.

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Editorial

B M Rao bmrao2010@gmail.com

It has been a great pleasure to present the new issue of " Megha". This issue coincides with the special occasion of World Meteorological Day – March 23rd. This year's theme selected by WMO is "powering our future through weather, climate and water" to illustrate the benefits provided by weather, climate and water information to different socioeconomic sectors. The issue features excerpts of WMO Secretary General's Message on this occasion.

We are happy to post the Message and greetings by Dr. Shailesh Nayak, President, IMS on this special occasion.

The present issue contains the interview of Dr. R R Navalgund, Director, SAC. It is a matter of great satisfaction to place on record the significant contributions of Dr. Navalgund, particularly in realizing the systems providing much needed space observations for Meteorology and Oceanography. IMDPS is a classic example of operationalising the INSAT data reception, processing and geophysical data generation at IMD, New Delhi. As always, he continues to provide a lot of suggestions for the professional societies like IMS to inform common public about the benefits of space technology to the society.

With the scheduled launch of INSAT-3D by the end of 2012 (only the second country after US operating GOES), the need for temperature and moisture profiles (under cloud-free conditions) over the Indian region, especially over the data-sparse Southern Indian Ocean would be fulfilled. The article on INSAT-3D provides the details of the proposed 19-channel Sounder and a 6-channel Imager on board the satellite and the likely results expected.

The article "Isotope applications in Hydrology Research" highlights the scientific challenges of quantitatively assessing the hydrological response to climate change. The role of IPCC in climate change through dissemination of information related to International policies and negotiations on climate related issues is also reported here. The recent cold wave conditions over North and Northwest India during February 2012 is also discussed for the benefit of readers.

We have started a new series - "learner's corner", wherein we will invite experts to discuss basics of important topics of relevance. This issue contains an article on 'wind chill'. We would like readers to give feedback on this attempt.

Incidentally, March 22nd also happens to be World Water Day. The importance of this day for a rain-dependent country, with vagaries of monsoon, like ours needs no emphasis. ***Here are some thoughts to ponder:*** The ever increasing population (7 billion people on planet today) and the need to provide safe drinking water to everyone poses a serious challenge. In addition, most of the water we 'drink' is embedded in the food we eat – e.g. a 1 kilo of wheat 'drinks up' 1500 liters of water to grow.The scandalous food wastage – 30 percent of the food produced worldwide is never eaten and the water used to produce is lost! No wonder the wastage of food grains in our country is always in news…….

We thank readers for the comments on the previous issue and hope you will continue to provide the feedback for the further improvement of "Megha".

Wish you all a very happy reading.

Secretary's Report

Dr. Sandip R. Oza sandipoza@sac.isro.gov.in

Through this special issue of Megha, let me brief the readers about the activities that took place in this quarter. In January, 2012, IMS-AC participated in organizing a one-day workshop on "Geo-informatics for Urban Planning", jointly with ISRS-AC, ISG-AC and INCA-GB, providing an opportunity for all the participants to engage in inter-disciplinary discussions. Although IMS-AC, through its Executive Council and the Editorial Board-MEGHA, took steps to revamp the outlook of "MEGHA" with the content and by increasing the frequency (now, quarterly), much more remains to be done in future. We are happy to inform you about the celebrations of World Meteorological Day on 23rd of March with a popular lecture by Dr. Sachin Mehta on "Climate and Health – Impact of climate change and extreme weather events". We also look forward for many more activities in the year ahead.

IMS-National Council President's Message

INDIAN METEOROLOGICAL SOCIETY

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MESSAGE

I have the great pleasure in addressing, the members of IMS – Ahmadabad Chapter, through this well-timed special issue of its Newsletter **MEGHA**, brought out on the occasion of World Meteorological Day.

As has been the tradition, the 23rd day of March is annually observed as the World Meteorological Day to commemorate the beginning of World Meteorological Organization (WMO) and is celebrated with a WMO – chosen theme, announced every year. The theme for this year, **"Powering our future through Weather, Climate and Water"**, is a pointer to the ever-increasing and widespread impact, that the three vital environmental components would have on individuals, societies, nations and the world at large. In fact, we already witness some of the emerging crisis, accentuated by global climate change, and the shape they are going to acquire in the no-so-distant future, it left unattended. It is now clear that any solution to climate and weather-driven crises, through policy-change and turn-around in existing socio-economic practices, must factor in studies of impact of weather, climate and water on existing resource management practices. At the same time, we, as a Meteorological community, must play our due part in awareness-creation amongst all sections of our society, especially various stakeholders.

Towards this end, **MEGHA**, the Newsletter of Indian Meteorological Society, Ahmadabad Chapter (IMSA) - is a right forum, for dissemination of ongoing scientific and technological developments towards mitigating meteorological hazards, in addition to various outreach programmes that IMS organizes every year.

I extend my sincere compliment to the society for its unstinted endeavors, all through these years and my best wishes for all future activities.

SRNayak

(Shailesh Nayak)

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Excerpts of message
"Powering our future with weather, climate and water"
Michel Jarraud, Secretary-General WMO

Every year, the 23rd of March, the World Meteorological Organization (WMO) and the international meteorological community join efforts to celebrate the World Meteorological Day to foster international collaboration in meteorology for the protection of life and property. By 1972, WMO had begun to expand its original mandate in meteorology and climate to include water as well as a number of environmental issues.

The World Meteorological Day celebration has focused each year on a selected key subject. The theme adopted by the WMO Executive Council for 2012 is "*Powering our future with weather, climate and water*", to illustrate the benefits provided by weather, climate and water information to different socioeconomic sectors. Such a theme seems especially appropriate this year, as in 2011 the 16th World Meteorological Congress unanimously agreed to launch in 2012 a Global Framework for Climate Services (GFCS). The 16th WMO Congress in 2011 also agreed that the four initial GFCS priorities would be disaster risk reduction, water, health, and food security.

The provision of weather, climate, and water-related information is also needed to support several vital socio-economic activities like agriculture, health, transport, energy generation and water resources management. In the course of the recent UNFCCC COP 17 session in Durban, WMO once more underscored that improved research, observations, prediction and capacity development will be essential elements for the protection of life and property in the most vulnerable countries.

Before concluding this Message, allow me to recall that the 2011 WMO Statement on the status of the climate, released recently, clearly underscores the continuing changes in our climate. The 13 warmest years on record have all occurred since 1997 and global temperatures in 2011 were higher than any previous La Niña year, an event which usually has a cooling influence. Concentrations of greenhouse gases in the atmosphere have continued to increase unabated, reaching an all-time high in 2011, while the extent of Arctic sea ice cover last summer was the second lowest on record and the overall sea ice volume was most likely the lowest ever registered.

We shall increasingly rely on the GFCS because, it will not only contribute to the climate change mitigation measures, but it will also be invaluable for natural disaster risk reduction. In the course of this vital endeavour, I am confident that the theme of World Meteorological Day 2012 will contribute to further engage all WMO Members and partners, at the highest level, in these key initiatives and so I wish to congratulate them most sincerely on the occasion of the World Meteorological Day 2012.

Original message available on www.wmo.org

Quote

Sunshine is delicious, rain is refreshing, wind braces us up, snow is exhilarating; there is really no such thing as bad weather, only different kinds of good weather.

-John Ruskin

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Tete-e'-tete with

Dr. Ranganath R. Navalgund, Director SAC

Sir, you have spent more than 3 decades in applying space technology for societal benefits. IMSA would like to hear your views/comments on these aspects, especially for weather and ocean applications

Space technology has evolved over a period of time and several advances in our observation capability have taken place. These have enabled many innovations in applications. Broad areas of applications of societal relevance which have emerged are (i) space data utilization in natural resources, like agriculture, forestry, ground water, glaciers etc, (ii) high spatial resolution data and stereo data usage for preparing topographic and thematic maps that are used in the field of infrastructure, urban planning and micro-hydel structures. (iii) improvement in weather forecasting (clouds, rain) at different temporal and spatial scales and determining the monsoon onset date, (iv) in ocean related studies like winds, waves, seamounts and mixed layer depth. The major application areas are in determining potential fishing zones, detecting probable sites for hydrocarbons, providing optimum ship routing and naval applications. (v) disaster monitoring and mitigation – in the areas of cyclones, droughts, storm surge, floods, forest fires and landslides.

Sir, what in your views are the strengths and uniqueness of SAC's participation / role in national weather and ocean forecasting programs?

SAC is a unique center where an entire gamut of activities happen under one roof. These range from design & development of instruments, development of pre-processing algorithms and deriving the geophysical products to assimilate them in numerical models, like ocean, weather and coupled models. SAC offers synergistic atmosphere where interactions among different groups in addition to collaboration with national/international organizations lead to generation of climate quality data products, their use in models and several useful applications.

Sir, any specific suggestions for areas of improvement in Space Applications Programme?

Improvement in weather forecasting skills that can directly help farmers is the first thing that comes to my mind. This essentially means that we should improve on seasonal and short to medium range forecasting skills. Mesoscale forecasting skills are necessary at Taluka/group of villages level. The real crux of the problem is to forecast the active and break cycles of the Monsoon and that too quantitatively. We understand the complexity as the uncertainty in error grows with the lead period. This requires more effort towards preparing good initial conditions and also the physics needs to be improved. Accurate rainfall estimates from satellites can also help in planning. Our groups are also involved in soil moisture estimation which serves as the boundary condition for accurate weather forecasting.

How important is the role of basic research in our application programs and linkage between these basic research and future satellite programmes?

Basic research helps us in understanding the physical interactions in the complex ocean atmospheric system. This helps us in improving the parameterization of the model processes to improve the forecast skills. What is important in the present scenario is to predict the anomalies in the Monsoon phenomena than the mean pattern. Yet another area where basic research can contribute is in system definition for the new satellite sensors for more accurate observations.

(cont.)

We understand that international collaboration is important for our space programme, however do you feel that it is also coming in the way of indigenization?

I strongly believe the need for international collaboration in this area of research. With the increase in the availability of number of parameters from satellites related to ocean, atmosphere, land, cryosphere and with the ever-increasing need to consider high spatial and temporal scales, collaboration is a necessity. We have a strong collaboration with NASA, NOAA, ESA and CNES on different satellite missions like OCEANSAT-2, Megha-Tropiques and SARAL. This also helps us in learning sophisticated and advanced retrieval techniques towards processing the data.

Sir, please suggest ways to strengthen the outreach program to popularize satellite meteorology and oceanography.

We all know that general public gets excited when they get to hear the news of satellite launches. This is alright, but what is required is to impart the knowledge regarding the usefulness of the data coming from these satellites. We need to explain them the benefits of the data for the societal applications. At the same time we should also be explaining them about the limitations of the space-borne data. This will also further support/strengthen our space programs. Now this can be achieved by different ways, one is to put the useful information related to weather and ocean on the website, prepare small monographs to convey basic information and also sensitizing researchers/scientists to visit rural/remote areas for imparting information. This is where the role of different professional societies would be very important.

There are not many opportunities for young students carrying out their post graduation from universities in the field of oceanography and meteorology. Can you give your views on how to generate more job opportunities for young researchers?

I am a firm believer that students should take up basic sciences like physics and mathematics till a certain level so that they develop analytical and mathematical skills and also have physical insights into any problem. At the early stages of education system, specialization should not be encouraged. Once they develop required skills to analyze and interpret the information, they can make use of these skills in specialized subjects like, meteorology and oceanography. Today however, job scenario is much better in these subjects than what it used to be earlier because of the need to develop sophisticated weather forecasting system, ocean observing system and also immense scope in studying the climate change impact. Today there is large number of opportunities as climate centers are being set up by MoES and ISRO. Younger generation can take advantage of this.

You have been always encouraging young researchers in space application. We would like to conclude this interview with a word of advice from you for them.

See, in the 1980's and 1990's we were happy with the qualitative knowledge gained from the remote sensing data about different earth resources. The present challenge is to know "how much"? e.g., we say glaciers are melting in the present day global warming scenario but that's not enough. It is required to know how much and why it is melting. Also, another important thing to know is the error statistics i.e., uncertainty with these estimates and for to do this, one requires necessary physical and mathematical skills to estimate and interpret these errors. So there is lot of scope in this area for the young researchers. My advice to them is not to compromise on even minutest aspect so that they can put themselves at international level. Sky is the limit when it comes to making use of space to understand the complexities and interactions amongst various components of the earth system. More importantly now they have other planets also to look forward to from space.

Thank you sir.

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Atmospheric profiles from INSAT-3D Sounder

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Accurate information of atmospheric temperature and humidity profiles with high spatial and temporal resolution are required for short to medium range weather forecasting. Besides this, the vertical information of atmospheric temperature and humidity is needed in several other weather and climate applications. Currently, NOAA operational satellites provide atmospheric profiles from polar orbits. These satellites can provide global observations with 1-2 days repetivity. However, applications such as nowcasting, short and medium range weather forecasting require observations at high temporal resolution. For frequent observations over a fixed geographical region geostationary satellites are required. At present only USA has sounding capability from geostationary satellite GOES. GOES provide temperature and humidity profiles over Continental USA and surrounding oceanic regions with one hour time interval. The importance of atmospheric sounding increases manifold in country like India because Indian region is severely affected by mesoscale deep convective systems. There are very few sounding observations are available over data sparse Indian Ocean. Therefore, India has scheduled to launch geostationary satellite INSAT-3D with infrared sounder towards the end of 2012. INSAT-3D will provide a wealth of new information on atmospheric structure in clear-sky conditions over Indian region at high spatial and temporal resolutions that will immensely improve mesoscale prediction.

INSAT-3D will carry 18-channel infrared Sounder (plus a visible channel for cloud detection during daytime) along with a 6 channel Imager. The spatial resolution of INSAT-3D Sounder observation is approximately 10 km at ground. INSAT-3D Sounder will have capability of sounding in the steps of 64 x 64 pixels taking less than 2 minutes and the time required for sounding the area covering 6400 km x 6400 km is approximately 3 hours.

INSAT-3D Sounder will make observations using several channels. These channels are sensitive to electromagnetic radiations (emitted from earth's surface or from different atmospheric layers) of different frequencies in the absorption bands of atmospheric gases. For channels with high absorption, the radiance received will be from higher altitudes. Similarly channels sensitive to frequencies at the wings of absorption spectrum (that is sensitive to low absorption frequencies) will receive maximum radiations emitting from surface or lower level of atmosphere. Hence, observations taken at judiciously selected wavelengths distributed over a broad absorption line will facilitate information of atmosphere at different altitudes. The mathematical model of a monochromatic radiation reaching at the top of the atmosphere can be given by a radiative transfer equation in non-scattering atmospheric condition. The equation is written in simple form as:

$$I_\lambda(p=0)=\varepsilon_\lambda.B_\lambda(T_s).\tau_\lambda(p_s\rightarrow 0)+\int_{p_s}^{0}B_\lambda[T(p)].\frac{\partial\tau_\lambda(p\rightarrow 0)}{\partial p}.dp+(1-\varepsilon_\lambda).\tau_\lambda(p_s\rightarrow 0).\int_{0}^{p_s}B_\lambda[T(p)].\frac{\partial\tau_\lambda(p\rightarrow p_i)}{\partial p}.dp \quad ---(1)$$

where, ε_λ is surface emissivity and $\tau_\lambda(p\rightarrow 0)$ is the vertical transmittance from level with pressure p to space. $T(p)$ is the vertical profile of temperature and $B_\lambda[T(p)]$ is the corresponding Planck function profile. This equation implies that the radiance received at a particular wavelength is sum of three terms on the right hand side: first term is upwelling radiance from the surface, second term is direct atmospheric emission term and the third term is reflected downward atmospheric emission reaching at satellite sensor. The term $W=(\partial\tau/\partial p)$ is popularly known as the weighting function. It specifies the layer from which the radiation emitted to space originates, and hence it determines the region of the atmosphere that can be sensed from space at this wavelength. Figure.1 shows the weighting functions for INSAT-3D Sounder.

(contd.)

It is evident from equation (1) that the measured radiance is a function of temperature (Planck's function is function of temperature for a given wave-number or frequency) and the amount of atmospheric gas (transmittance is a function of amount of atmospheric gas). In order to infer atmospheric temperature information from the measurements of thermal emission, the source of emission must be a relatively abundant gas of known and uniform distribution. Otherwise, the uncertainty in the abundance of the gas will make ambiguous the determination of temperature from the measurements. Carbon dioxide is one such gas in the atmosphere having uniform known mixing ratio for altitudes below about 100 km, and has emission bands in the spectral regions that are convenient for measurement, e.g. 15µm.

Since we have a limited number of channels the inversion of equation-(1) is ill-posed or under-constrained mathematical problem because atmospheric state (unknown, e.g. temperature profile) is a continuous function of height, and measurements are from a finite number of channels. This means that there exist an infinite number of profiles that satisfy the set of measurements. Inverse problem is to find reasonable unique solution. In addition, the measurements always contain some error or "noise". This further increases the ill-posed nature of the problem, and we must find a method of solution that does not amplify the noise to an unacceptable degree. This implies that we need ancillary information besides the measurements in order to obtain solution closest to physical atmospheric condition. For atmospheric remote sensing, this ancillary information is obtained from numerical model forecast and surface observation analysis.

INSAT-3D Sounder observations will provide vertical profiles of temperature and humidity in clear-sky conditions besides total column ozone and various other derived products. A retrieval package has been developed by the Atmospheric and Oceanic Sciences Group at Space Applications Centre for this purpose. The expected accuracy of retrieved profiles is 1-2 K for temperature profile and 20-30% for water vapour.

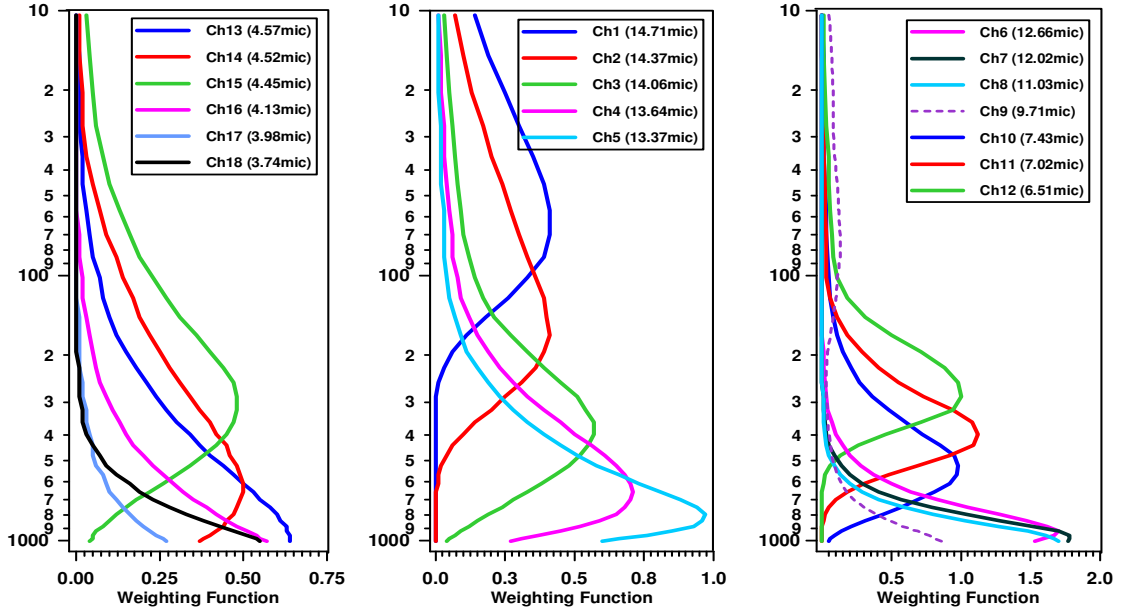

Fig.1: INSAT-3D Weighting Function over Indian Region

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Isotope Applications in Hydrology Research

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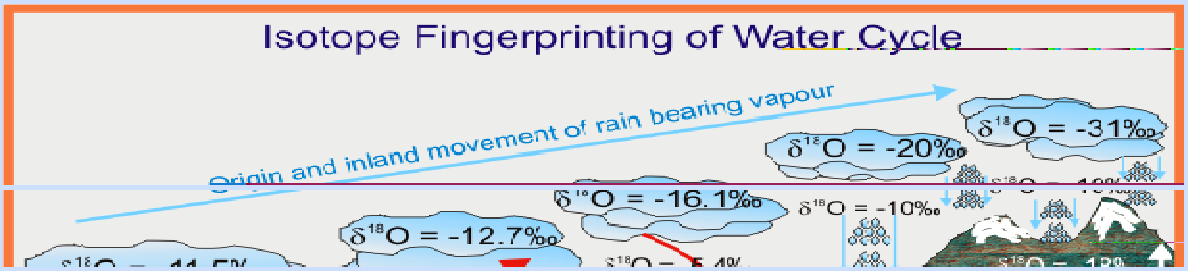
Beyond the cliché of population explosion and water scarcity lays the real scientific challenge of quantitatively assessing the hydrological response to climate change so that appropriate mitigation and adaptation strategies can be decided for efficient water resource management and sustainable socio-economic development. The subsurface, surface and atmospheric components of hydrological cycle are so intricately coupled that assessing, lest quantifying, hydrological changes across the globe is much more difficult than assessing the change in temperature or the levels of green house gases. In addition to global warming, the regional hydrological cycles are also influenced by engineered interventions (dams, canals, recharge structures, etc) implemented to meet the growing water demand, and other anthropogenic factors (urbanization, land use pattern, agricultural practices, etc) affecting consumptive usage of water. The hydrological scenario that we are faced with is thus, a sum total of global warming, anthropogenic impact and manifestation of long term natural variability. Under these circumstances, while hydrometric approach of monitoring the volumes and fluxes (rainfall, water levels in rivers and wells, soil moisture, relative humidity, etc) is important, it is also important to understand the subtle hydrological processes by characterizing the water in various hydrological cycle components and tracing the movement and mixing of water across various hydrological boundaries. Change in the vapor source region, local recycling of vapor and its bearing on soil moisture regime, sub-cloud evaporation, regional evapo-transpiration, evaporation from flowing rivers and stagnant water bodies, surface water – groundwater interaction and exchange, contribution of glacial melt in stream discharge, etc are some the important hydrological issues which are required to be studied in detail, essentially to provide strong scientific inputs for informed policy decisions.

In this context, study of oxygen and hydrogen isotopic composition of water and vapour has immense potential for addressing hydrology related current issues of both scientific and societal importance. The stable isotope ratios of oxygen ($^{18}O/^{16}O$) and hydrogen (D/H) can be used to characterize various components of hydrological cycle, including vapor, and to understand the possible causes of observed spatio-temporal variations in isotopic signatures. Application of water isotope ratios for tracing the hydrological cycle is based on the principle that lighter isotopic molecular species of H_2O preferentially evaporate whereas heavier ones preferentially condense, imparting characteristic but spatio-temporally variable isotopic composition to all the hydrological reservoirs (Figure 1). The isotopic composition is expressed in terms of abundance ratio of heavy to light isotopes ($R = {}^{18}O/{}^{16}O$ or D/H) reported as δ in per mil (‰) units as [$\delta^{18}O$ or $\delta D = (R_{sample}/R_{std} - 1) \times 1000$]. The two isotopic ratios R_{sample} and R_{std} respectively refer to the sample and the internationally accepted standard reference water. Potential of this technique to understand various aspects of hydrological processes has been proven in research publications, including several from India. However, most of these studies dealt with one of the hydrological components (rainwater, riverwater, groundwater, lake water or ocean water), until a coordinated research programme for isotope monitoring was initiated by Physical Research Laboratory (PRL), in which all components of hydrological cycle of India are being isotopically monitored.

A National Programme on Isotope Fingerprinting of Waters of India (IWIN), funded jointly by the Dept. of Science and Technology (DST), Govt. of India and PRL is currently underway which aims at isotopic characterization ($\delta^{18}O$ and δD) of various components (sea-surface water, atmospheric water vapor, rain, ground- and river water) of hydrological cycle over

(contd.)


Isotope Fingerprinting of Water Cycle
Origin and inland movement of rain bearing vapour
δ18O = -31‰
δ18O = -20‰
δ18O = -16.1‰
δ18O = -10‰
δ18O = -12.7‰

Hydrograph separation and precipitation source identification using stable water isotopes and conductivity: River Ganga at Himalayan foothills. A.S. Maurya, Miral Shah, R.D. Deshpande, R.M. Bhardwaj, A. Prasad and S.K. Gupta Hydrological Processes, DOI: 10.1002/hyp.7912, 25, 1521-1530 (2011).

IWIN National Programme for isotopic characterization of Indian Hydrological cycle: Preliminary Results. Deshpande, R.D. and Gupta, S.K. Proceedings of the 11th ISMAS Triennial Conference, Hyderabad, India. pp 95-107, (2009).

IWIN National Programme: New Hydrological Insights. R. D. Deshpande, Medha Dave, Raj Laxmi Singh, S. K. Gupta. Proceedings of the 14th ISMAS Symposium cum Workshop on Mass Spectrometry. Munnar, India. pp 95-108, (2011).

Dust Storm Conditions in March 2012 from Satellite Imagery and NCEP

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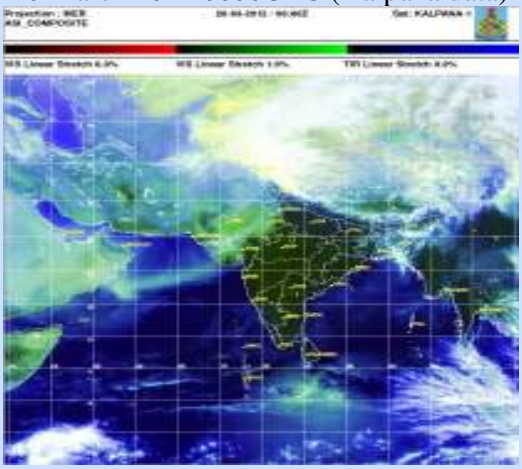
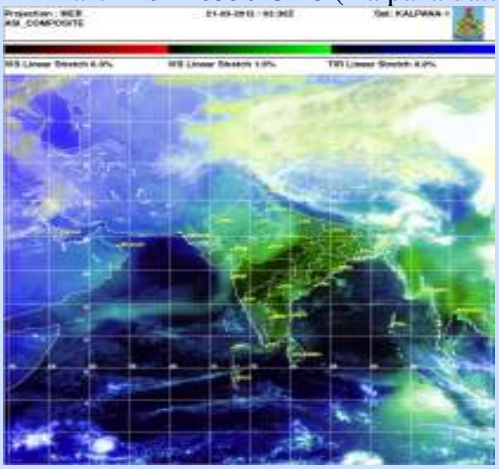
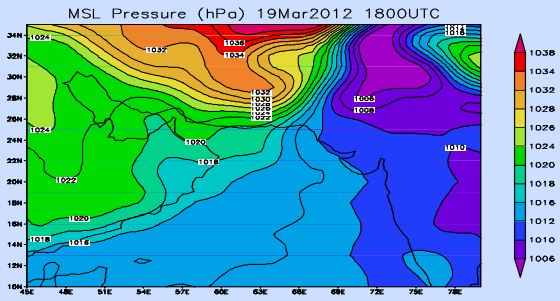
Strong surface pressure gradient over Baluchistan/Afghanistan associated with the passing of a western disturbance caused heavy winds. This caused dust storm over Baluchistan, Afghanistan and Iran on the evening of 19 March 2012. The dust spread south/southeastward along with the prevailing wind, reached south of 20°N over Arabian sea and Gujarat, Rajastan, Punjab and Haryana states of India by 20 March 2012. On 21 March 2012, dust further spread south/southeast ward covering parts of Uttar Pradesh, Madhya Pradesh states. Major cities like Mumbai, New Delhi, Ahmedabad, Bhopal, Jaipur, etc were loaded with lot of dust. Due to the dust storm, visibility reduced considerably. It was likely to cause health problems and disrupt air, rail and road traffics.

20 March 2012 0600UTC (Kalpana data)

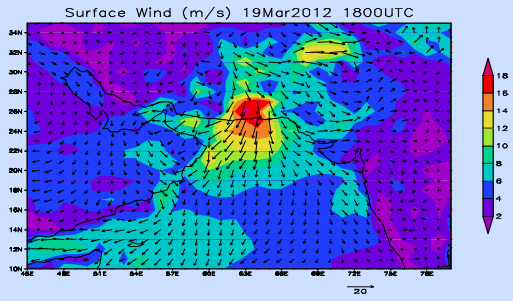


21 March 2012 0330 UTC (Kalpana data)





Mean sea level Pressure (hPa) from NCEP



Surface Wind (m/s) from NCEP

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Understanding Climate Change and the role of IPCC

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Lead Author, IPCC WGI AR5

Climate Change is one of the best examples for interdisciplinary studies that involve physical, biological and social sciences and its impacts on human and natural systems are long-term, irreversible and global in nature. Thus, a need was realized for the participation of global scientific community for a comprehensive assessment of climate change science and literature. The **I**ntergovernmental **P**anel on **C**limate **C**hange (**IPCC**) was established in 1988 under the auspices of the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) with the purpose to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. IPCC is the leading interdisciplinary and intergovernmental body for the assessment of climate change. It comprises of 194 participating countries, and is governed by United Nations rules and regulations. The IPCC Secretariat is hosted at WMO headquarters in Geneva. IPCC mobilizes scientific experts from around the world to carry out assessments of global climate science based on the available relevant literature. The IPCC does not conduct any research nor does it monitor climate related data or parameters. It has the responsibility of informing international policies and negotiations on climate related issues based on the assessment mainly on published and peer-reviewed scientific and technical literature.

IPCC is structured into three working groups and a Green House Gas inventory taskforce. Working Group I: "The Physical Science Basis of Climate Change" deals with the physical science, understanding processes, projections and attributions of climate change. Working Group II: "Climate Change Impacts, Adaptation and Vulnerability" assesses the impacts of climate change on natural ecosystems, socio-economic systems; the vulnerability of the systems; as well as the potential adaptation strategies and practices. Working Group III: "Mitigation of Climate Change" examines technology and policy options to mitigate climate change along with an assessment of related costs and benefits. The main objective of the Task Force on National Greenhouse Gas Inventories is to develop and refine a methodology for the calculation and reporting of national GHG emissions and removals.

Since 1990, IPCC has successfully produced four assessment reports; First Assessment Report (FAR 1990), Second Assessment Report (SAR 1995), Third Assessment Report (TAR 2001), Fourth Assessment Report (AR4 2007) along with a number of special reports, and greenhouse gas inventory guidelines. The Fifth Assessment Report (AR5 2013) is in progress. IPCC has very rigorous and robust procedures and guidelines for preparing the assessment reports largely based on synthesis of peer-reviewed and published scientific literature. Review is an essential part of the IPCC process. It is elaborate, involving two formal reviews and one or more informal reviews of preliminary text. After considering the review comments, the Lead Authors of each chapter prepare the second draft, which is reviewed by the experts and by government representatives. Two or more Review Editors for each chapter oversee the review process, ensuring that review comments are handled appropriately. The recognition of IPCC assessments came with the award of Noble Prize in 2007. Few of the most useful products of IPCC include the Summary for Policymakers (SPM) and Greenhouse gas inventory guidelines which are used by all the countries of the world in preparing and reporting their greenhouse gas emissions.

The approved outline of the Working Group I contribution to the IPCC Fifth Assessment Report AR5 'The Physical Science Basis of Climate Change' encompasses more detailed and improved understanding of climate change assessment as compared to the previous assessments. It would include synthesis of knowledge on Observations and Paleoclimate information, past and current global, continental and regional greenhouse gas emissions, process understanding of carbon and other biogeochemical cycles & clouds and aerosols, from forcing to attribution of

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climate change, sea level changes including cryosphere, future climate change and projections as well as modeling of ocean-earth-atmosphere.

Succession of IPCC Assessment Reports since the First Assessment Report in 1990

Carbon cycle is being assessed within a dedicated end-to-end chapter in WGI AR5 which includes interactions between carbon and other biogeochemical cycles, particularly the nitrogen cycle, feedbacks with the climate system which are relevant for near- and long-term climate projections, paleo information that has provided evidences for past changes in Carbon and other Biogeochemical cycles, and related climate feedbacks. An Atlas of Global and Regional Climate Projections will be provided as Annex I of the WGI AR5. The Atlas will include maps for key physical variables, simulated for a range of scenarios, for various time horizons within the 21st Century. The Working Group I is currently being co-chaired by Prof. Thomas Stocker and Prof. Qin Dahe. 44 countries are being represented and out of the total 258, nine Indian scientists are contributing as Coordinating Lead Authors and Review Editors to various chapters of the Working Group I contribution to the IPCC Fifth Assessment Report. Lead Authors are at the heart of the whole IPCC assessments.

Recent Cold wave conditions over Gujarat

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Severe cold wave condition prevailed over Gujarat in February 2012. Gujarat experienced lowest temperatures of this winter season in February. Around 9 February 2012, a western disturbance moved east of Gujarat. Due to this clear sky conditions prevailed over Gujarat, which favoured nocturnal cooling by radiation processes. Steep north-south pressure gradient also led to the setting of the strong cold & dry north- north westerly winds over Gujarat which caused further fall in minimum temperatures. As a consequence, minimum temperature fell by 5°- 9° C over Gujarat on 9 February 2012.

Station	Minimum temperature on 9 Feb 2012 (°C)	Departure from normal (°C)	Lowest minimum temperature (°C) ever recorded in February	Date/Year of lowest minimum temperatures
Ahmedabad	5.2	-9 (SCW)	2.2	6/1920
Rajkot	7.2	-5 (CW)	1.1	8/1893
Bhuj	6.0	-6 (CW)	0.3	22/1984

Legend: CW- Cold Wave SCW- Severe Cold Wave

Source : India Meteorological Department

Issue: Jan-Mar MEGHA 2012
World Meteorological Day Issue

A brief report on one-day workshop

"Geo-informatics for Urban Planning"

(Jointly organized by ISRS-AC, ISG-AC, IMS-AC and INCA-GB on January 7, 2012)

Vast opportunities, available in the cities of India, are leading to the tremendous growth of urban population. This demands an integrated scientific urban development plan. In this context, a one-day workshop on "Geo-informatics for Urban Planning" was organized at SAC, Ahmedabad, jointly by local chapters of ISRS, ISG, IMS and INCA associations. The event witnessed the presence of national presidents of ISRS and IMS and national vice-president of IMS, in addition to the chairman of the local bodies. The invited talks on workshop themes like Urban Planning, Urban Infrastructure Development and Urban Environmental Assessment were informative. The workshop was attended by more than 200 participants including students, faculties, scientists and engineers. More than 25 posters presented by students is one of the highlight of our outreach program. Another important highlight of the workshop was the discussion on the importance of climatology and forecast of extreme weather and seismic events in the comprehensive urban development plan, which helps the policy makers and executioners in their mitigation plan during natural hazards.

Reality Bites

"KALPANA 1 (METSAT) VHRR completed 1 Lakh Image scans in the orbit and is still operational with 46 images a day."

This may be the world record.

(Communicated by Shri K. N. Mankad, Associate Project Director, INSAT 3D, 3DR, 3DS & GISAT Payloads, SAC)

Issue: Jan-Mar MEGHA 2012
World Meteorological Day Issue

A brief report on 17th National Space Science Symposium

This year ISRO sponsored 17th National Space Science Symposium (NSSS-2012) which was organized by SV University, Tirupati during February 14-17, 2012. The research papers presented in the symposium covered the wide range of subjects including space based meteorology/oceanography, Geosphere-biosphere interactions, middle atmosphere dynamics, ionosphere, magnetosphere, space weather, sun-earth relationship, astronomy, astrophysics and the solar system bodies including planetary system. These papers were divided into five suitable plenary sessions. The highlight of the symposium was three Special Plenary Sessions (SPS).

SPS-1 was on Advances in Astronomy. Experts have discussed two mega-projects in astronomy proposed by Indian astronomers, detection of neutral hydrogen at high red-shifts for the understanding of evolution of structure formation in the universe and near field cosmology with dwarf galaxies. Invited lectures in this SPS were delivered by Prof. Ajit Kembhavi, IUCAA, Pune, Prof. Shiv Sethi, RRL Bangalore and Prof. Jayaram Chengalur, NCRA-TIFR, Pune.

SPS-2 was on Megha-Tropiques (MT), in which challenges in realizing the MT mission, science perspective and preliminary results were discussed by Dr. G. Raju, ISRO, Bangalore, Prof. J. Srinivasan, IISC, Bangalore and Dr. P. K. Pal, SAC, Ahmedabad.

The polar research was the topic of SPS-3. Shri Rasik Ravindra, NCAOR, Goa, gave an overview of the geo-scientific studies in the polar region and their relevance to climate. "Antarctica as an alternate to Mars for existence of life" was discussed by Dr. S. Shivaji, CCMB, Hyderabad, that was followed by the talk of Dr. C. G. Deshpande, IITM, Pune, on Indian endeavours in atmospheric science studies in the polar regions.

Another attraction of the NSSS-2012 was inter-disciplinary lectures on (i) Cosmology by Dr. Biman Nath, RRL, Bangalore; (ii) Climate and Weather of Sun-Earth System by Prof. Sridharan, PRL, Ahmedabad and Neutrinos in Physics and Astronomy by Dr. Rajasekharan, IIMS, Chennai. Prof. G. Srinivasan, RRL, Bangalore delivered an interesting popular lecture on 'Accelerating Universe" in which he discussed the concept of accelerating universe and its implications.

Inputs by: Dr. Sandip Oza

Forth-coming Events

COSPAR-2012

The objectives of Committee on Space Research (COSPAR) are to promote, on an international level, scientific research in space, with emphasis on the exchange of results, information and opinions, and to provide a forum, open to all scientists, for the discussion of problems that may affect scientific space research. The Indian Space Research Organisation (ISRO) (www.isro.gov.in) is organizing the 39th COSPAR Scientific Assembly (COSPAR-2012) in Mysore, India during 14-22 July 2012. The venue planned is Infosys Training Centre, Mysore (www.infosys.com). Detailed information can be obtained from www.**cospar**-assembly.org/
The theme of COSPAR 2012 is **"Space - for the benefit of Mankind".** The topics to be addressed during the conference are -- Fundamentals of space science, Relevance of Space Science, Applications and Technological Innovations.

PORSEC-2012

The rapid progress in ocean remote sensing in the 1980s provided the stimulus for constituting the Scientific Organizing Committee (SOC) of the Pacific (Pan) Ocean Remote Sensing Conference

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(PORSEC) during the International Space Year 1990. PORSEC has provided over a decade of effort with over thirty countries and agencies participating to advance the science capabilities in developing countries by organizing biennial conference.

The Indian National Centre for Ocean Information Services (INCOIS), Ministry of Earth Sciences, Government of India is privileged to host PORSEC-2012, the Eleventh Biennial Conference with the Theme ***"Ocean Remote Sensing for Well-being of All"*** in Kochi, Kerala, India during November 05-09, 2012. Detail information can be obtained from http://www.porsec2012.incois.gov.in/

LEARNER'S CORNER

What is Wind Chill ?

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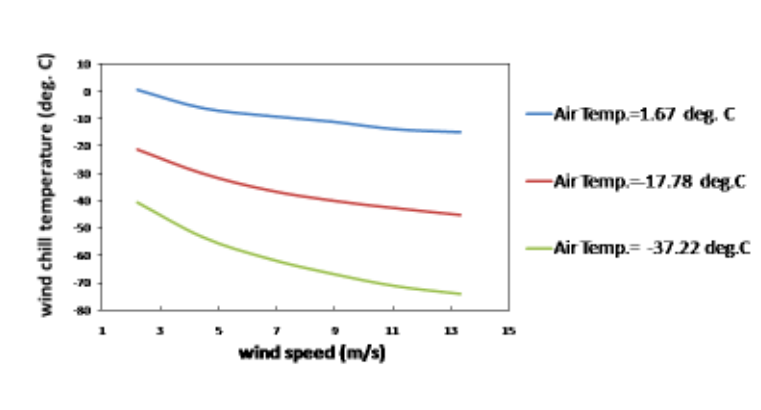
Why do windy winter days seem so bitterly cold? A winter day with a strong wind can seem much colder than one with a mild wind, though air temperature may be exactly the same. The effect that wind has on our perception of cold is called the WIND CHILL FACTOR. The greater the wind speed, the faster we lose body heat. Wind Chill can make a fairly moderate winter day equivalent to a much colder one – sometimes dangerously so. For example, a day with a temperature of 30 ºF (about -1 ºC) might seem of little concern, but combined with winds of 10 miles per hour, it can feel like it's 21 ºF (about -6 ºC).

The human body loses heat through the physical processes of convection, conduction, evaporation and radiation. The rate of heat loss by a surface through convection depends on wind speed above that surface: the faster the wind speed, the more readily the surface cools. For most biological organisms, the physiological response is to maintain surface temperature in an acceptable range so as to avoid adverse effects. Thus, the attempt to maintain a given surface temperature in an environment of faster heat loss results in both the perception of lower temperatures and an actual greater heat loss increasing the risk of adverse effects such as frostbite.

The following curves are based on a popular empirical model for Wind Chill Temperature. Try yourself and calculate the Wind Chill Factor for various combinations of temperature and wind speed using the graph below.



Pictures: Courtesy Abhisek Chakraborty