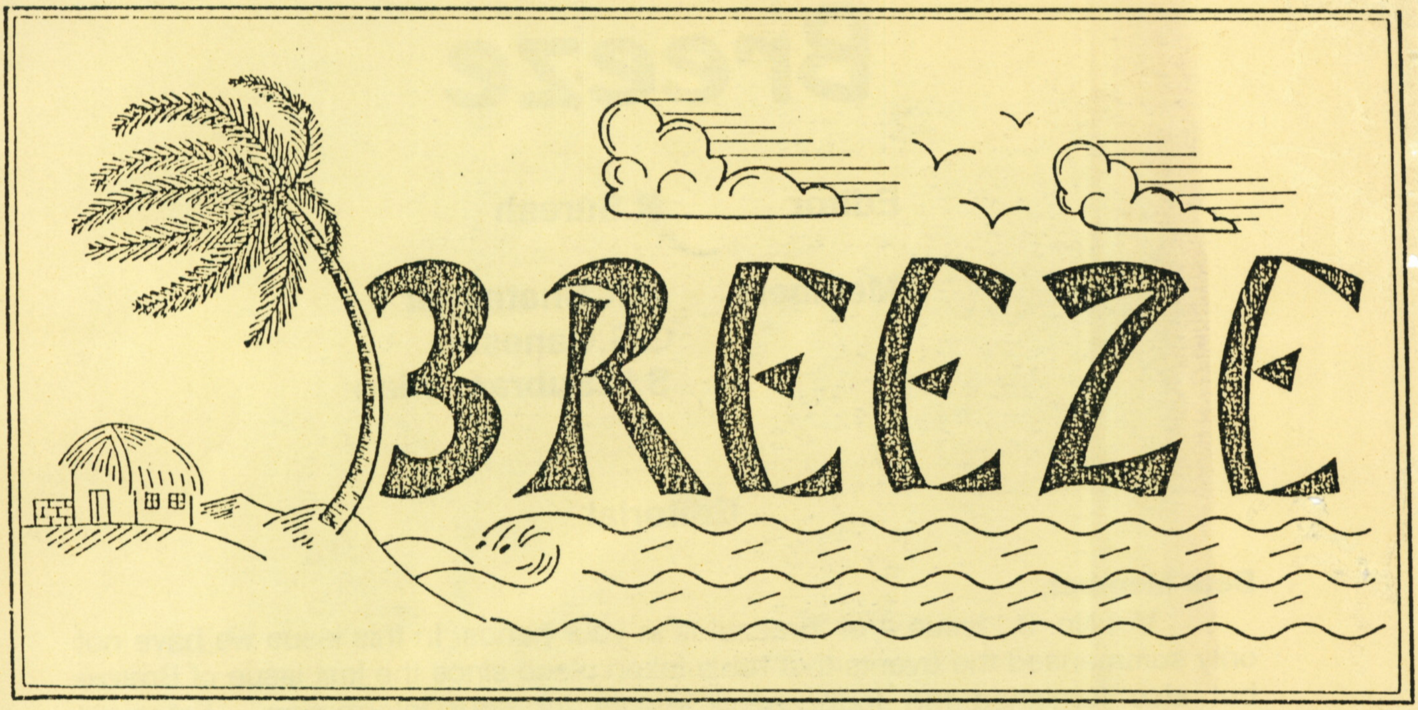

The news letter of Indian Meteorological Society, Chennai chapter

Vol 3 Issue 2 July - December 2000

Breeze

Editor R.Suresh

Members A.K.Bhatnagar
G.S.Ganesan
S.K.Subramanian

Editorial

Dear Member,

Vol No. 3 , Issue 4 of 'Breeze' is in your hands. In this issue we have not only summarised the events that have taken place since the last issue of Breeze but also furnished the forthcoming events for your information. Extended abstract of lecture delivered by Shri.D.V.Subramanian on 08.08.2000 on the present day topic of interest, viz., "Rainwater Harvesting" has been included in this issue besides other informative contributions by our members. This issue of Breeze can also be browsed at URL : *www.geocities.com/imsmds*. Directory of our chapter has been inserted as an annexure.

Wish you a thought provoking reading.

Chennai
10.08.2000

Editor

Status of the membership of IMS Chennai chapter as on 10.08.2000

Fellows	01
Life members	50
Annual members	93
Total	144

Websites Of IMD

S.K.SUBRAMANIAN

For an organisation like India Meteorological Department (IMD), which delivers a lot of information to outside agencies and the general public in the form of observational data and weather forecasts, it is of great advantage to have a website of its own. Technological advances in Information Technology can be put into maximum use for presenting the latest and accurate weather information by the department which were hitherto restricted to either the daily weather column appearing in the print media or a few weather bulletins which are broadcast / telecast by AIR/TV as a routine. The rapid increase of internet usage and the ever increasing need and high expectation of quick and accurate weather information and forecasts among the general public are some of the factors which make websites related to weather so important these days.

Though IMD has been maintaining a website (URL:www.imd.ernet.in) for quite some time on an experimental basis, the same was modified in a most professional manner recently and is available for browsers since 1 June 2000. This new site was designed and developed by CMC Limited and contains a lot of weather related information. The information contained in this site can be broadly grouped into two categories viz., (i) IMD products and (ii) information.

Under the former category, which contains essentially the products of operational weather forecasting in the form of Special Monsoon Report, All India Weather Report etc. Severe weather warnings, outputs from satellite division in the form of global or sector INSAT imageries (visible and IR), rainfall maps, earthquake reports, local weather information and forecasts of capitals of all states and union territories etc, weather charts (actual and forecast) which are essentially the products of Limited Area Model(LAM) of Regional Specialised Meteorological Centre (RSMC), New Delhi and temperature, wind charts, which are the products of Regional Area Forecast Centre (RAFC) , New Delhi, Climatological normals of rainfall, temperature etc are included.

The second category is more of informatory nature like the history of IMD, organisational structure, network of observatories, services rendered etc. This site also provides links to WMO and the met. services of a number of foreign countries and other organisations at home.

Regional Meteorological Centres at Chennai (URL: http://education.vsnl.com/imdchennai), Mumbai (URL: www.imdmumbai.gov.in) and Calcutta (URL: http://education.vsnl.com/calweather) have also put up their own websites to provide weather information / forecast pertaining to their region.

Efforts are made to put up weather information of tropics like maximum temperatures during summer, progress of monsoon during monsoon months, cyclone warning bulletins and other cyclone related information during the cyclone period, minimum temperatures during winter months, highlights on unusual occurrence of any type of weather phenomena etc. These websites are periodically revised to improve the quality and content of presentation.

Indian Meteorological Society (IMS), Chennai Chapter has also put up a website (URL: www.geocities.com/imsmds) the first of its kind for the IMS.

Economic Benefits of Meteorology

S. RAGHAVAN

1. Weather has a value.

Traditionally, meteorological services in all countries have been the responsibility of National Governments and all meteorological information – current weather, forecasts and climatological information have been available free to any one, although considerable investment and effort has gone into the production of such information. A principle which has been accepted by all countries is that meteorological information will be exchanged internationally free of barriers and free of cost. Hence all the data which we send abroad through the Global Telecommunication System are free, even though we spend a substantial amount for gathering these data. It has to be so, because if we wish to charge the other countries, by the same logic, they can charge us.

However, what is obtained free, appears to have no value to the recipient! It has been increasingly recognised in the last four decades that meteorological information has great economic and "social" value in various sectors of human activity. For example, by taking advantage of weather or climate information a farmer can plan his operations better or a businessman can regulate the stock of weather-sensitive items to effect maximum sales. Or again, a pilot can reduce his fuel intake if a tailwind is forecast. And, climatological data are used for planning the location of industry, construction of structures and so on.

The maximum impact of weather information is not so much in the form of monetary gains but in the saving of lives and property in severe weather events (such as tropical cyclones, severe thunderstorms and rain-induced floods). The magnitude of damage due to a cyclone is such that, if the forecasts and warnings mitigate the damage due to one cyclone by 10%, the cost of the entire meteorological organisation would be more than paid for. But it is impossible to quantify how many lives were saved by the warning (and what value can be assigned to that) or even how much property damage was averted. Warnings for severe weather are considered to be the duty of the Government and therefore the costs are debited to the public exchequer. It is necessary, therefore, to recognise this as a **"Social Benefit"** and put a notional monetary value on it.

There is a greater awareness and interest in weather information among the public in recent years, probably largely brought about by TV weather presentations in which the satellite imagery is the most prominent visual component. These presentations give an (incorrect) impression to viewers that all weather forecasting is based exclusively on satellite imagery. Nevertheless, this **societal awareness** and **psychological Impact** on the public may be viewed as a social benefit and again a notional value put on it.

There are several meteorological outputs which are not operationally used and may not contribute to day-to-day weather forecasting. But they bring about long-term benefits by way of improved climatological knowledge, better understanding of meteorological processes and development of improved models for forecasting. These also need to be assigned some value. The future potential from research facilities is also relevant.

2. Studies on the value of the weather.

The pioneer in the study of the socio-economic benefits of weather information is probably W.J. Maunder of New Zwealand who wrote a book on the subject (Maunder, 1970). Since then there have been several studies, the majority of them in economics journals, which are generally not seen by meteorologists. The World Meteorological Organisation (WMO) (1990) organised a conference on the subject, which was attended by two Indian meteorologists. One surveyed the Indian scene though there is no quantitative estimation of benefits or losses. The other conducted a survey of the role and status of meteorological and hydrological services in WMO Regions II and V in economic and social development. Cost-Benefit Analyses of Meteorological Services, in general or of specific services have been made in many countries. An analysis specifically in respect of the METEOSAT weather satellite programme has been done in Europe (Bramshill Consultancy Ltd., 1993).

The need for evaluating the benefits and costs of meteorological services arises in several ways. Governments perceive a need to justify to parliament etc. the investments and expenditures on various services. Recognition of the economic benefits of a service, may lead to greater allocation of funds for that service and therefore a more effective service. Recovery of costs for a service, from beneficiaries will also help improve the service. The effective use of meteorological information (discussed in detail later) depends on factors other than meteorological, and therefore an evaluation of real benefit, (as distinct from the quality of the information), is needed. While the costs are relatively easy to calculate, quantification of the benefits is complicated.

Commercialisation of services is a trend in all countries. One approach is that while general forecasts, warnings and data are in the public domain, any processed output meant for a particular customer is charged for. For example, an industry requiring an analysis of weather impact over a proposed installation can commission a consulting meteorologist to advise them. This is common in many countries and has started happening in India too.

The National Meteorological Services of some countries (e.g. U.K., Sweden, Norway, New Zealand, Argentina) have themselves started charging for their products –except for some basic services - in the last two decades. For example weather enquiries in UK are answered through high-value telephone calls. And television presentation brings money to the Meteorological Office. In India, climatological data are charged for by THE India Meteorological Department (IMD), though not perhaps, at a rate commensurate with the cost of data collection. IMD also charges for aviation forecasts and gets reimbursement from certain organisations for establishing special meteorological services for them. Climatological data for research organisations are also charged for, though the research community strongly feels that this should be free. Evaluation of costs and benefits are obviously desirable in fixing the charges to be levied.

International exchange has costs and benefits; as charges are usually not levied, the latter may have to be assigned a monetary value. Some data are put on the internet without charge and these also have to be assigned a notional monetary value. It is said that in future some countries propose to charge for satellite meteorological data.

3. Methodology.

The European Study, referred to above, in respect of the METEOSAT satellite was limited to the improvement in *forecasting* due to that satellite. It compared pre-METEOSAT and post-METEOSAT forecast performance. Various meteorological services in Europe were interviewed to determine the contribution of METEOSAT to forecast improvement, as distinct from the contributions due to better ground-based observations, better computer models etc. The study also interacted with consumers of weather information in various sectors in UK. (The results were extrapolated to other European countries).

For a realistic assessment of benefits it is important to get the perceptions of *users* of various categories directly instead of depending solely on the views of the meteorologists. The effectiveness E of meteorological information is the product of three factors S, C, and R (Raghavan, 1996; Raghavan and Sen Sarma, 2000),

$$E = S \times C \times R \qquad (1)$$

Where S represents Science or Skill i.e. the contribution of the meteorologist,
C represents Communication i.e. the timely transmission of information *and* its proper understanding and assimilation by the recipients, and
R represents the Response i.e. the action taken by the recipients.
If any one factor is zero the product is zero, however good the other two may be.

This formula was enunciated in the context of tropical cyclones but it is true in other areas also. E.g. if a tail wind is forecast for an aircraft flight and if the airline does not use it to adjust its fuel intake and payload, there is no net benefit from the forecast. Similarly, if a warning of severe weather does not reach in time or if it is misunderstood or it is not acted upon, the warning is ineffective.

Hence this analysis will help not only to improve the weather service but the organisations for dissemination and use of the information.

Most human activities are weather-sensitive. But this does not necessarily mean that availability of weather information will produce specific benefits or savings. This may be because the phenomenon cannot be predicted with a reasonable degree of confidence or with adequate lead time, or because the information cannot be communicated in time or because nothing can be done about it or even because of a tendency to play safe (e.g. the airline case mentioned).

For assessing the benefits, organisations or individuals in various user sectors can be queried. Fifteen sectors (considered most relevant in Indian conditions) are listed below in alphabetical order: agriculture, aviation, disaster managers, energy, environment. fisheries, industry and business, insurance sector, marine interests, media and the public, oil exploration, railways, telecommunications, tourism and water resources management. (Others such as health could be added).

Attitudes to weather differ. .A question like "Will you be willing to pay for a weather forecast?", addressed to a city-dweller, may simply elicit a "No". On the other hand a farmer will be able to appreciate a weather forecast better. In some countries an idea of losses due to severe weather can be obtained from *insurers* based on the claims received by them. In our country this may not be an adequate approach as insurance is not common except in some sectors like shipping and organised business.

Weather information is crucial on certain occasions; e.g. when a cyclone or flood or fog or hail occurs. The rest of the time, the accuracy of the information or forecast may not matter. Hence routine statistics of forecast accuracy may not be useful indicators of benefits.

There are various classes of consumers of weather information who can cite specific instances of how they have benefited from it, but may not be able to give an overall figure for a whole year or so. This is because weather information will be seen as relevant only on certain occasions. E.g. a grape farmer in Nasik would be interested in forecast of ground frost in winter and will be able to take remedial measures and make a significant saving. The rest of the year he may not be able to recall any significant benefit. A warning of a cyclone or flood may enable a businessman to safeguard his goods or a farmer to advance his harvesting. Film industry people telephone the meteorological office to know if they will get a sunny day, but are otherwise not keenly interested in weather forecasts. Hence instead of a routine statistical approach, instances of benefits in the past several years may be collected from various sectors.

A good recent example is a qualitative Economic Impact Assessment of their Agrometeorological Advisory Service, attempted by the National Centre for Medium Range Weather Forecasting (NCMRWF, 2000). This is based on specific case studies. It is desirable that more comprehensive studies are undertaken in India.

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Some Fundamental Facts About Madden-Julian Oscillation (MJO)

N.JAYANTHI

MJO also popularly known as the 40-50 day oscillation is the most important form of atmospheric variability of intraseasonal time scales in the tropics. MJO essentially is an eastward propagating, equatorially trapped wave with baroclinic oscillation in the tropical wind field. The propagation speed is of the order of 6m/sec in the eastern hemisphere where it stays, interacts and modulates deep convective activity. In the western hemisphere the speed of propagation is almost double and is more than 12 m/sec as it propagates without much influence on the cloud field.

Thanks to the use of spectral analysis in the field of Meteorology, several atmospheric waves were explained like mixed gravity waves, Kelvin waves in the stratosphere using time series analysis from tropical rawinsonde data. By using Canton island rawinsonde data and computing spectra and cross spectra variates, Madden and Julian (1971) noticed large coherence between surface pressure, zonal winds and temperature over a broad period that ranged between 41 and 53 days.

Since its discovery by Madden and Julian, a number of studies have been undertaken to characterise the space-time structure, its origin and to simulate and forecast its behaviour in numerical models.

Several authors have reported similar such results indicating the equatorial oscillation in different levels of the atmospheres. In India it was Keshavamurthy (1976) who reported 30 day period in the 850 hPa winds over India and suggested the north-south oscillation of the monsoon trough. The northward propagation was later confirmed through several studies of Indian monsoon by Sikka and Gadgil (1980), Yasunari (1981) , Krishnamurti and Mehta (1988). Yasunari also related this oscillation to active and break periods of the summer monsoon.

Interactions between MJO related anomalies in convection and large scale circulations are strongest in the eastern hemisphere over the Indian and western Pacific Oceans where the oscillation exhibits its greatest variation and typically reaches its maximum amplitude. Also coupling with the tropical ocean in association with westerly wind bursts due to the passage of an MJO event can significantly modify the structure of the thermocline in the equatorial Pacific Ocean. This interaction has been suggested to play an important role in triggering the ENSO events. Similarly the cloud, OLR, Low level precipitable water vapour from TOVS data etc. have also indicated evidence of eastward propagating cloudy areas in the equatorial region with wave number one to two in zonal scales.

The MJO or the 40-50 days oscillation has certainly provided necessary mechanism for understanding the atmospheric process and their variabilities and still providing a vast source for understanding the importance of atmospheric general circulation and in particular, monsoon and also offers a vital clue for long range forecasting due to its time scale of the order of more than a month.

Hence continued research to improve our understanding of this oscillation will go a long way in predicting the weather and climate in a much better way.

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Bad Meteorology

We come across a lot of wrong information about meteorology (and other sciences too) in textbooks, magazine articles, TV and now on the internet. An example is a school textbook which says that water "condenses" from clouds and becomes rain – forgetting that the cloud itself is the result of condensation of water vapour.

Alistair Fraser of Pennsylvania State University in the USA has a web site primarily to dispel such misinformation and to provide correct answers to various common questions on Meteorology. The url is http://www.ems.psu.edu/~fraser/BadMeteorology.html

Examples of what he says:

"The reason clouds form when air cools is that cold air cannot hold as much water vapor as warm air".

Wash your hands of this emetic explanation.

"Raindrops are shaped like teardrops".

Weep over this artistic licentiousness.

"The greenhouse effect is caused when gases in the atmosphere behave as a blanket and trap radiation which is then reradiated to the earth."

Reject this explanation as nothing but hot air.

"The water in a sink (or toilet) rotates one way as it drains in the northern hemisphere and the other way in the southern hemisphere. Called the Coriolis Effect, it is caused by the rotation of the earth".

This nonsense deserves to be flushed. "

He gives explanations of these phenomena and many more. There are also links to sister sites such as "Bad Astronomy", "Bad Science" etc.

He also invites visitors to his page to contribute more material debunking howlers we come across.

Readers of Breeze will find these sites interesting.

- S. Raghavan

Rainwater Harvesting (RWH)

D.V.SUBRAMANIAN

Introduction

At present Tamilnadu is facing an acute scarcity of water and keeping its fingers crossed, hoping that the timely onset of NE monsoon will solve this problem. The reduced storage in the water supply reservoirs due to lack of foresight on the part of successive governments, have led to the current dependence and overexploitation of the ground water sources for our daily domestic requirements of this basic necessity. If this trend continues, the Ground Water Table (GWT) runs the risk of large scale intrusion by sea water, a situation very difficult to reverse . Hence the requirement to recharge the GWT by rainwater which otherwise drains into the sea during the rainy season . This is a matter of great urgency . Though the topic has been coming up every year during the summer season (when water gets priority in the media over other subjects) during the last decade, there has been no sustained follow-up actions.

This year, there is greater awareness of the importance of rainwater harvesting among the citizens firstly because they have been driven to the wall and secondly, due to the publicity given by the Metrowater board . The plan suggested to the residents of single houses or flat dwellers, is to arrange for draining the rainwater runoff from open terraces and roofs into any existing well / borewell, or into specially prepared pits in the space surrounding the building so that the water which is otherwise wasted , is made to percolate into the GWT.

Basics

Estimation of water which can be harvested from open terraces or roofs is simple and illustrated in Fig. 1

In a place with an annual rainfall of 125 cm as is the case with Chennai, a 200 Sq.m open terrace harvests 200 x 1.25 Cu.M ie., 250 kilo litres (= 30 Metro water tankers approx.) which is quite a large quantity of fresh water .

The runoff for the first few minutes which flushes the atmospheric pollution and collecting surface impurities, is allowed go waste .An efficiency factor is included in the arithmetic to allow for this quantity. When all houses in a given locality implement RWH and the water is drained into wells, a significant rise in the water level in wells can be expected. Or, if the water is made to reach the GWT by means of filter / percolation pits, one can imagine the quantity of water which will go to recharge the GWT, the water table in the area will be seen to rise. Besides the replenishment, the quality of water is bound to show definite improvement .

Historically, before the advent of centralised storage of domestic water supply and its distribution thru' a network of pipes came into vogue, people used water from wells & tanks which filled up during the rains. *RWH was in place then, without conscious effort.* In fact, underground rainwater storage systems are still in existence in old houses in Rajasthan and Gujarat and other places in India..Elsewhere in the world also, traditional rainwater catchment systems for domestic use existed from time immemorial; These are known as *Djabir* in East coast of Africa, *Abanbar* in Iran, *Shuijiao* in China, *Chultun* in

Yucatan Peninsula in Mexico and *Adobe Granary bins* in Mali. Mostly, these were sub-surface storage systems .

RWH systems for domestic and other use around the world.
Since the Hydrological decade, there is greater awareness in many countries around the world of the use of rainwater for a sustainable life style .Though in India, the focus is on RWH for recharging the depleted GWT only, other countries have been harvesting rainwater from open terraces / roof tops for direct domestic use after simple filtering and treatment.
Australia & New Zealand, South Africa, Botswana, Kenya & Zambia in Africa, Thailand, China & Japan in Asia, Germany in Europe and some of the states in USA represent a cross section of countries around the world where RWH systems are being increasingly used for domestic consumption for various reasons.

Use of Roof runoff catchment systems for domestic water supply is common in many parts of **Australia**. The arid climate, the widely scattered rural population (10%) and the high cost of developing groundwater sources have made RWH, the only cost effective option for rural Australia.
As for urban areas, rainwater tanks are a common sight in Adelaide, capital of South Australia because of the poor quality of water from Murray River, the only source of surface water for the city. This scenario fits very well with the water conservation policy of Southern Australian Govt. which gives active encouragement for RWH by providing detailed guidelines, for storage, maintenance of quality etc.

New Zealand , similar to Australia , has a widely scattered & sparse rural population but climatically, more humid. But the volcanic nature of the ground and the high iron content of ground water have led to the adoption of roof runoff rainwater systems as the most cost effective option for all domestic supply.

Botswana is a semi-arid land locked country , 85% is covered by deep Kalahari sands with no surface water. Ground water is rare and when available is saline. But the mean annual rainfall ranges from 25 - 65 cm which makes RWH an attractive proposition and has in fact been in use for the last 30 years. Roof catchment sytems and storage tanks are a common sight on primary schools in villages (800 +).
The important point in Botswana is that RWH schemes are subsidized to the extent of 85 % of the cost, by the Govt.

RWH systems are better developed and more widely used in **Kenya** than in any other African country . In fact the designs have been adopted for use in Uganda, Tanzania, Ethiopia, Namibia and Botswana (Fig 2).

Thailand established itself as a leader in household RWH systems in the eighties due to a Govt. initiated Domestic rainwater supply project. More than 10 million households in rural Thailand regularly use of runoff rainwater, collected and stored in the popular 2 Cu.M reinforced cement jars

In **China**, due to the vast and varied nature of the country, the context in which rainwater is used for domestic purposes is different from region to region. Absence or shortage of good quality ground or surface water in the arid central and western regions ; absence of easily accessible water sources in the foothills and mountains surrounding North China plain , have made roof & surface runoff catchment systems an attractive proposition.

(Fig.3). Even in the fast growing megacities of Shangai and Beijing pressure on water supply have led to over exploitation of ground water. In these urban areas, RWH is done mainly for recharging the GWT.

RW collection has a very long history in **Japan** .Traditional systems still exist on the outlying islands in the Pacific and Japan Inland Sea . Most of the islands are volcanic and some of them are populated with communities of 200 - 10,000 people. Rainfall is regular - 200 cm - 300 cm / year. Reliance on rainwater collected by roof catchment systems is very high on these islands. Rainwater collection is also common on the islands of the Okinawa Prefecture stretching from Japan towards Taiwan. Though centralised water supply through pipes are available on some big islands , the widespread existence of household rainwater collection systems are justified by the fact that they are *decentralized* and have served as a backup supply when natural disasters struck in the past.

In Asia, Japan is the leader in the utilisation of rainwater in the urban context. Household collection of rainwater for non-potable use is encouraged by the Govt. by increasing subsidies. While in rural areas of Japan, rainwater collection is normally done for household water supply, in large Japanese cities, rainwater collection in households and public buildings is for several other reasons as well, namely, for improved flood control, reduced river pollution, countering over-exploitation of ground water and associated subsidence problems , for fire fighting and standby supplies for emergencies ; and last but not least, to effect significant saving on drainage infrastructure.

The Japanese have also constructed some very large roof and ground catchment systems in several cities to reduce local flooding problems, to decrease dependence on centralized supplies, to reduce water bills, and to provide a backup emergency supply. One of the best known is the Kokugikan sumo wrestling stadium where water from the 8400 sq.m roof is stored in a 1000 Cu.M rservoir in the basement Fig. 5. Another interesting example is the Izumo Dome in Izumo city where the rainwater runoff from the huge dome and surroundings with a total catchment area of 13,200 Sq.M are stored in storage tanks. This is reported to have resulted in an estimated annual savings of 14,000 US$ on water bills.

In the U.S, though rain collecting barrels of the 19th century have been gradually replaced by borehole and piped supplies even in rural America the rainwater collection systems continue . A published survey estimated 200,000 rainwater systems being used for domestic water requirements of small communities and individual households. These include the island states in the Pacific and Carribean. Ohio state alone has 67,000 RW systems in use. Rest are to be found in the states of Arizona, California, Texas, Florida, Kentucky, New Mexico, Pennsylvania and Virginia. In recent years, a combination of growing environmental awareness and increasing pressure on conventional water sources, has led many water supply authorities to consider the option of rainwater collection and active promotion. In Austin, Texas , installing a Roof runoff collection system gets a subsidy of 30% of the cost, up to a ceiling of $500 !

In Europe Germany leads in promoting widespread utilisation of RWC systems both for domestic supply and other purposes. Due to serious air pollution in many parts of the country, rainwater is not recommended for drinking but for all other non potable applications. An illustrative example is shown in Fig. 4

RWH possibilities in India

With its varying geographic and climatic zones, the scope for RWH for different purposes is unlimited. For a start, the Govt. has to set an example by implementing RWH in its own buildings, big and small, (i) for recharging the GWT (ii) for direct collection of rainwater for potable and non-potable use by offices located in the building. Suitable filtering and water treatment systems have to be installed to facilitate this objective. Two schemes for Chennai are proposed by the author to illustrate the possibilities.

The new landmarks of Chennai , its fly overs are of two widths , 7.5 m and 15 m . The average length is 600 m. Rainwater has to drain through outlets on both sides of the road into a common drainpipe , carrying the water into storm water drains near the foot of the fly over at both ends. Ideally, no rainwater is expected to flow down the slope along the length . In heavy rain situations, significant volume of water will flow towards both ends along the road and flood the road on level ground. This might occur even due to choked drain holes on the fly over.

The rainfall runoff potential of the fly over is 600 m x 7.5 m x 0.01m = 45 Cu.M or 45 kilo litres *per cm of rainfall.* To put in layman's language, this is like emptying 5 Metro Water tank loads (MWTLs) of water on the fly over. In a normal monsoon year, the RWH potential of the single carriageway fly over is about 625 MWTLs.

By providing a percolation pit of suitable width across the road at the entrance and exit to the fly over, covered by non-pilferable "cattle guard " type steel cover , the runoff water flowing down the slope will go down the percolation pits to recharge the GWT. Assuming that the balance , say 50 % of the water exits via the drainpipe, this water can be stored in tanks of suitable sizes at the foot , below the fly over after filtering in a simple sand - pebble filter tank and chlorination treatment. The water collected could be used for fire fighting, Civil construction work, watering public gardens and any emergency supply for the local residents. The visible benefit would be the prevention of flooding of the level road below.

The second example is the RWH potential on the large arched roofs of the MRTS stations. The projected area of the roof in horizontal plane is 4620 Sq.m (210m x 22m). *For every cm of rainfall*, the runoff from the roof would be 46 kilo litres or 5 MWTLs . The rainwater that can be harvested in a normal year from this roof, works out to 5 x 125 = 625 MWTLs. At present, all this water literally goes down the drain as storm water, to add to the surface runoff which finally empties into the sea. During the northeast monsoon alone (Oct - Dec), this quantity works out to 5 x 77 = 385 MWTLs

By filtering the roof runoff to remove dirt and other solid impurities, the water can be treated and stored even as potable water - for use after boiling - in the station cafeteria etc.. If the quality does not permit such use, it can still be used for non-potable applications such as, general wash water & toilet flush at the station premises or just an emergency supply for the locality.

At present we have 5 stations of similar design and 7 more or expected to come in the next two years. These provide a golden opportunity to have a dozen decentralized water supply points with a capacity of 3000 kilo litres each , of rainwater, along the MRTS.route.

RWH by individual houses / block of flats for immediate domestic water supply should be encouraged by the Govt by giving incentives like rebates on quarterly water charges collected at present as otherwise there is no motivation for implementing RWH schemes.

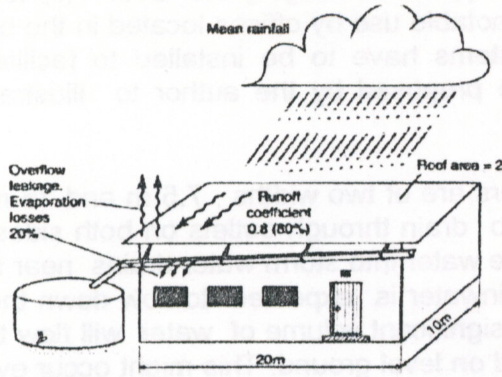

Fig. 1. Basic Roof runoff catchment system

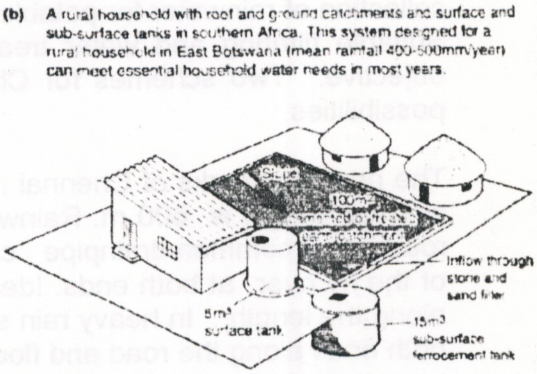

Fig. 2. Typical roof runoff surface catchment system in East Africa

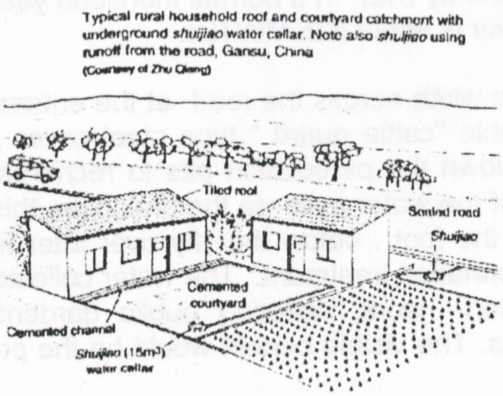

Fig. 3. Roof / surface runoff catchment system in China

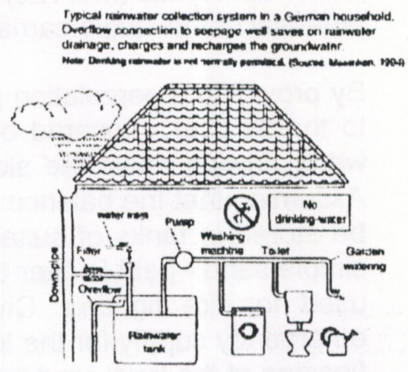

Fig. 4. Roof runoff catchment system in a German household

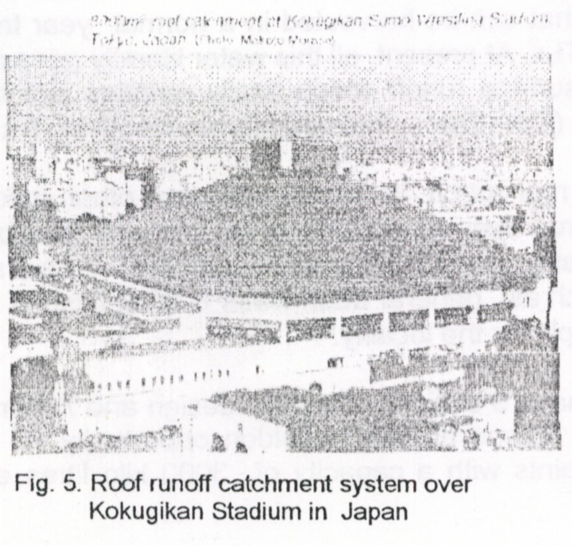

Fig. 5. Roof runoff catchment system over Kokugikan Stadium in Japan

Directory of IMS, Chennai chapter as on 9.8.2000

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Shri.	K.S.Achari	A-93	RMC, Chennai 6.
Wg Cdr	S.S.Agarwal	A-96	IAF, Tambaram, Chennai 46.
Shri.	P.Ajaykumar	A-92	MO, Chennai 27.
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Kum.	B.Amudha	LM-721	RMC, Chennai 6.
Shri.	V.Anandan	A-91	RMC, Chennai 6.
Kum.	S.Anila	A-94	RMC, Chennai 6.
Shri	A.Anna Durai	LM-843	SERC, Chennai 113.
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Shri.	S.Balamurugan	B-199	RMC, Chennai 6.
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Shri.	S.Bhagavathsingh	B-193	MO, Chennai 27.
Shri.	M.Bharathiar	B-192	RMC, Chennai 6.
Shri.	A.K.Bhatnagar	B-179	RMC, Chennai 6.
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Shri.	S.Govindachari	G-37	MO, Chennai 27.
Shri.	T.Govindaraju	R-256	RMC, Chennai 6.
Shri.	M.V.Guhan	G-112	RMC, Chennai 6.
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Shri.	P.Karthikeyan	K-161	RMC, Chennai 6.
Shri	D.R.Krishnan	K-184	RMC, Chennai 6.
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Smt.	G.C.Meenakshi	C-67	RMC, Chennai 6.
Shri.	G.Mohanan	M-32	AH-63, Anna Nagar, Chennai 40.
Wg Cdr	J.K.Mukherjee	M-187	IAF, AFAC, Red Fileds, Coimbatore 18.
Kum.	A.J.Murikan	M-136	RMC, Chennai 6.
Shri.	P.Muthukrishnan	K-162	RMC, Chennai 6.
Shri.	E.K.N.K.Nair	N-55	MO, Chennai 27.
Shri.	R.Nallasamy	N-27	RMC, Chennai 6.
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Shri.	P.Perumal	P-142	RMC, Chennai 6.
Shri.	A.S.Ponnuswamy	P-61	RMC, Chennai 6.
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Shri	G.Prakash	P-186	RMC, Chennai 6.

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Shri.	K.S.Radhakrishnan	R-251	RMC, Chennai 6.
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Shri.	K.Rajendran	R-208	RMC, Chennai 6.
Shri	G.Rajendran	R-288	RMC, Chennai 6.
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Shri.	N.Ramamoorthy	R-290	RMC, Chennai 6.
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Shri.	S.R.Ramanan	LM-747	MO, Chennai 27.
Shri.	A.N.Ramanathan	R-289	RMC, Chennai 6.
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Shri	G.Ramesh Babu	LM-802	SERC, Chennai 113.
Shri.	M.S.Ranganathan	R-71	RMC, Chennai 6.
Shri.	C.Ranganathan	LM-728	14K, V.O.C Road, Cantonment,Trichy 1.
Shri	D.Rangarajan	R-291	RMC, Chennai 6.
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Shri	P.C.S.Rao	LM-723	RMC, Chennai 6.
Shri.	M.Ravichandran	LM-628	NIOT, IIT Campus, Chennai 36.
Shri.	P.V.Revikumar	R-119	RMC, Chennai 6.
Shri	Sai Prasad	P-187	MO, Chennai 27.
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Shri.	A.K.Selvakumar	S-358	MO, Chennai 27
Shri.	N.Selvam	S-393	RMC, Chennai 6.
Shri.	K.Selvarajan	S-406	MO, Chennai 27.
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Shri.	P.Shanmuganathan	S-441	H/32 Venkatapuram, Chennai 15.
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Dr.	T.R.Sivaramakrishnan	LM-669	F4, Chandra Apts., 15 Race Course Rd., Guindy, Chennai 32.
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Shri.	S.Sridharan	S-106	RMC, Chennai 6.
Kum.	S.Stella	S-451	MO, Chennai 27.
Shri	K.Subba	S-449	RMC, Chennai 6.
Shri.	D.V.Subramanian	LM-730	Flat 8, Krishnakutir, 11 Justice Sundaram Road, Mylapore, Chennai 4.
Shri.	S.K.Subramanian	S-203	RMC, Chennai 6.
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Shri.	I.P.Sudhir	S-383	RMC, Chennai 6.
Shri.	E.R.Sukumar	S-205	RMC, Chennai 6.
Dr.	R.Suresh	LM-498	RMC, Chennai 6.
Shri.	V.N.Thankappan	T-19	RMC, Chennai 6.
Shri.	S.I.T.Thomas	LM-72	1C, Professors' Colony, Tambaram East, Chennai 59.
Gp Capt.	K.I.Trivedi	LM-667	IAF, JC Nagar, Bangalore 560 006.
Kum.	B.Umarani	R-257	RMC, Chennai 6.
Smt.	B.Usha	LM-744	RMC, Chennai 6.
Shri.	T.V.Vaidyanathan	LM-732	Plot 9, Rajajinagar Avenue Extn., Valasaravakkam, Chennai 87.
Shri.	R.Venkatesan	LM-671	IGCAR, Kalpakkam 603 102.
Shri.	R.Venkatesan	V-83	MO, Chennai 27.
Shri.	K.Vijayaraghavan	V-57	RMC, Chennai 6.
Dr.	T.R.Visvanathan	LM-663	3A, Dr Annie Besant Avenue, Sree Nagar-Colony, Thirumullaivayal, Chennai 62.

Addresses of the Institutions/Departments/ affiliations

CDR	.. Cyclone Detection Radar, Port Trust building, Chennai 600 001.
IAF	.. Indian Air Force
IGCAR	.. Indira Gandhi Centre for Atomic Research, Kalpakkam 603 102.
IIT	.. Indian Institute of Technology, Chennai 36.
MO	.. Meteorological Office, Old Airport, Meenambakkam, Chennai 600027.
NIOT	.. National Institute of Ocean Technology, IIT Campus, Chennai 36.
RMC	.. Regional Meteorological Centre, 50 College Road, Chennai 600006.
SERC	.. Structural Engineering Research Centre, CSIR Campus, Taramani, Chennai 600 113.
TNAU	.. Tamilnadu Agricultural University, Coimbatore 641 003.

Events since last issue of Breeze

1. TROPMET-2000:

Since the last issue of Breeze was brought out, the major event relating to the Society was TROPMET-2000 held at Cochin University of Science and Technology from 1 to 4 February 2000. Several of our Members from Chennai attended.

The main theme was "Ocean and Atmosphere". The inaugural function was presided over by Prof. Babu Joseph, Vice-Chancellor of the University. Dr. A.E. Muthunayagam, Secretary, Department of Ocean Development inaugurated the Symposium. Dr. R.R. Kelkar, Director General of Meteorology, India Meteorological Department gave a special lecture on "Atmospheric Science – Challenges for the new millennium". Shri A.K. Bhatnagar, Deputy Director General of Meteorology, Regional Meteorological Centre, Chennai presented the Proceedings of TROPMET-99 to the President IMS. Two life-members of the Society (Shri S. Raghavan and Prof. U.C. Mohanty) who were elected Fellows in 1999 were presented the fellowship and citation. Besides 16 invited talks a large number of papers were presented in three simultaneous sessions.

A boat trip and a cultural programme were arranged. The Organisers had made excellent arrangements for the Symposium.

Kochi is normally fairly dry in February. This time there were severe thundershowers at night probably because of the *convergence* of Meteorologists there! There was fog (again, unusual in Kochi) one morning – a result of the lack of clarity of the discussions?

2. The IMet.S, Chennai Chapter in collaboration with the RMC, IMD, Chennai conducted a one day "Seminar on Weather and Climate Education" for senior school teachers, on 10 February 2000. The Tamil Nadu State Council for Science and Technology (TNSCST) graciously gave a grant of Rs. 10000 for the Seminar. After welcoming remarks by Shri A.K. Bhatnagar, the seminar was inaugurated by Dr. K. Subramanian, Member-Secretary, TNSCST. There were two lectures by Shri S. Raghavan and Shri G.S. Ganesan followed by a discussion session and visit to the facilites at the RMC. The teachers who attended welcomed the concept and wanted it to be repeated yearly. All the teachers were given Certificates of participation.

3. The IMet.S, Chennai Chapter in collaboration with the RMC, IMD, Chennai conducted a Quiz for high school students on 15 February. The quiz master was Dr. N. Jayanthi. Several organisations contributed the prizes given to the winning students. All the students were given Certificates of participation.

4. Under the joint auspices of the Chapter and RMC, Chennai, the following lectures were delivered.
   (1) Prof. Sethu Raman, North Carolina State University, USA, on "How can the meteorologists help solve the water problem? – Coastal effect on rainfall distribution". 16 February 2000.
   (2) Shri A.K. Bhatnagar, DDGM, RMC, Chennai, on "Problems of calendar in India", 18 April 2000
   (3) Smt. C.K. Gariyali, IAS, Vice-chairperson, Science City, Chennai on "Science for all". 20 June 2000.
   (4) Shri D.V.Subramanian, Director (Retd.), IMD on "Rainwater harvesting – The long and short of it" on 8 August 2000.

5. Local Council met on 18 April 2000 and Annual General Body Meeting of the Society was held on 23 May 2000.

6. The Chennai Chapter has launched its own web site. This is the first in India. The address is www.geocities.com/imsmds/index.html. We thank Shri A.K. Bhatnagar, Dr. Y.E.A. Raj, Shri S.K. Subramanian and Dr. R. Suresh who conceived the idea and developed the site. Members are invited to visit it and give us feedback for further development.

7. The Proceedings of TROPMET-99 are now available for sale at a specially low price of Rs. 500 (post-free). Rs. 300 for Members.

   The latest Membership of Chennai Chapter is:
   Annual Members: 93; Life Members: 50; Fellows: 1.

We thank all the Members of the Society who worked hard to make all these events a success. Our special thanks to the DDGM, RMC, Chennai for providing all the facilities.

8. The Science City, Chennai runs a monthly quiz competition (one subject each month), on their web site *www.tamilnaduscientists.com* for school students. Mrs C.K.Gariyali, IAS, Chairperson, Science City offered to have the July 2000 quiz on Meteorology if our Society gives the questions. On behalf of the Society, Dr N.Jayanthi was requested to give the questions. The quiz was conducted from 20 to 23 July. The results have been announced and the winning students will get prizes.

FORTHCOMING EVENTS

TROPMET-2001 at Mumbai from 6-9 February 2001. The theme will be "Meteorology for Sustainable Development". This will be followed during the year 2001 (dates will be announced soon) by

a) An International Symposium on Monsoon to be conducted at New Delhi by IMD with collaboration of I.Met. S., WMO and several foreign Meteorological Societies. The first session will be "Sir Gilbert Walker Commemorative Session on Seasonal Forecasting of Monsoon", this being the centenary year of Sir Gilbert Walker.
b) INTROMET-2001, which is the once-in-four years International TROPMET, will be held by the Society at Ahmedabad. (The previous INTROMET was held at New Delhi in December 1997).

The following events of interest to us are expected to be held at New Delhi in March 2001.

1. 19 and 20 March – Mega event on "IMD's 125 years of dedicated service to the Nation".
2. 21 and 22 March – 'International Conference on Forecasting Monsoons from Days to Years" (Indian Meteorological Society will be one of the organisers).
3. 23 to 28 March – 2nd WMO Workshop on Monsoons (IWM-II) on the theme "Forecasting Monsoons from Days to Years".
