



Information Brochure

South Asian Forum for Agricultural Meteorology



Harvesting of Paddy before flash flood warning in Bangladesh



Sensitisation Programme on Agrometeorology in Afghanistan



Crop Damage due to Extreme Events in Bhutan



Capacity Building Programme in Myanmar



Crop Simulation Modelling Training in Nepal



Rice Cultivation in Sri Lanka



Weather monitoring device installed near an agricultural field in Pakistan



Maldives Meteorological Services



Feedback from Farmers in India

Importance of Agricultural Meteorology

Agricultural meteorology is concerned with the meteorological, hydrological, pedological and biological factors that affect agricultural production and with the interaction between agriculture and the environment. The subject is gaining importance across the world as it helps cutting the costs of farm inputs, increasing input use efficiencies, increasing production, cultivation cost minimization, quality improvement, loss minimization, leading to more farm production with economic considerations, environment protection etc under the different benevolent, malevolent and extreme weather conditions and also in the era of increasing climate stress and climate crisis. In the recent past the agrometeorological advisory services have become the need of hour and becoming quite popular. With growing science & technology some aspects of the subject are developing and needs greater attention in future to enable the science of agrometeorology better serve the farmers. They include data (observation to data transmission, data storage, quality control, data supply, data base management system and data use in modelling for decision making) weather forecasting including extreme weather events, understanding weather-crop-soil-pest/disease relations etc. All will ultimately be used to advise the farmers in their farm management practices. It also calls of use of dissemination and Information and Communication Technologies (ICT), crop/soil/pest-disease monitoring particularly through remote sensing, bio-climatic interaction based agrometeorological products, machine learning, artificial intelligence, risk mitigation, impact assessment etc to improve the quality of the service.

Regional Cooperation on Agrometeorology in South Asia

Despite the technological and scientific progress, the agricultural production and quality are highly weather and climate dependent in South Asia. Also, agriculture has a challenge to cope with climate change and variability and extreme weather conditions which significantly impact farm production in this region. At present there is need to enhance the quality of weather forecast and climate services and more so on application of meteorological information in various sectors particularly in agriculture in South Asian Region (SAR). There are number of constrains in application side of agrometeorology especially in SAR where the operational agro-met advisory services are in different stages. There are number of countries in South Asia that are lacking in these areas and the farmers in these countries badly need these services for the better livelihood As far as the applications of weather and climate information to agriculture are concerned, the agromet community in South Asia really have important role to play. Though different governments and semi government agencies are making their best efforts in improving the quality of life of farming community in this region, the agromet community in South Asia have to collaborate among themselves and more important is the involvement and cooperation across the boundary of the nation in this region. There are number of constrains in application side of agrometeorology especially in this region. Therefore, need was felt to establish the regional cooperation to resolve the shortcomings of operational agrometeorological services in South Asia Region. Based on this, the Idea of formation of SAFOAM is floated. South Asian Forum on Agricultural Meteorology (SAFOAM) was launched on 9th February, 2021 to strengthen regional cooperation in agrometeorological advisory services of the member countries in South Asia. These initiatives were very much required for food policy, food quality, food security better livelihood in South Asia. Sixty-two members from seven countries namely, Afghanistan, Bangladesh, Bhutan, India, Myanmar, Nepal and Sri Lanka participated in this endeavour. This effort is very timely as many new developments in this area are happening concurrently in this region. The aims and objectives of SAFOAM also would be free exchange of ideas to help sharing of knowledge and information respecting the administrative set up within the respective government in member countries.

Objectives:

Among others, the key aims & objectives of SAFOAM are:

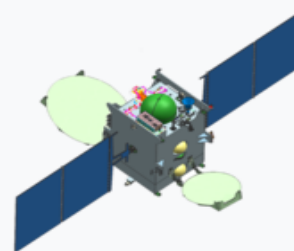
- ❖ Enhance agro-meteorological information sharing.
- ❖ Improving impact-based forecasting skills with special emphasis on high-impact weather events in agricultural sector.
- ❖ Develop agromet decision support tools.
- ❖ Deliver user-oriented services to farmers.
- ❖ Address common implementation challenges.

Other Regional Cooperation on Application of Meteorology in South Asia

South Asia Satellite for the Services of Meteorology & its Application in South Asia



South Asia Satellite



Names	GSAT-9
Mission type	Communications / Meteorology
Operator	ISRO
COSPAR ID	2017-024A 🔗
SATCAT no.	42695
Website	GSAT-9 🔗
Mission duration	Planned: 12 years ^[1] Elapsed: 4 years, 8 months, 25 days

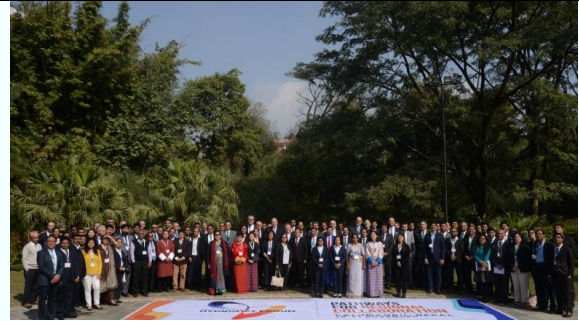
The South Asia Satellite, formerly known as SAARC Satellite, is a geostationary communications and meteorology satellite operated by the Indian Space Research Organisation for the South Asian Association for Regional Cooperation region. The satellite was launched on 5th May 2017. During the 18th SAARC summit held in Nepal in 2014. As of 2019, the satellite is in service with all SAARC countries. Important features of the South Asia satellite are as follows.

- South Asia Satellite caters to Nepal, Bhutan, Maldives, Bangladesh and Sri Lanka. Afghanistan.
- SAARC satellite is dedicated to our neighbourhood as a gift from India".
- Honourable Prime Minister of India Narendra Modi has actually extended his slogan 'Sab Ka Saath Sab Ka Vikas' to India's neighbourhood essentially to service the needs of the poor in South Asia.
- The satellite enables a full range of services to neighbours. The areas include telecommunication, television, direct-to-home, VSATs, tele-education and telemedicine.
- It is also equipped with remote sensing state of the art technology which enables collection of real-time weather data and helps in observations of the geology of the South Asian nations.
- It also provides secure hot-lines among the participating nations, which will be useful in case of management of disasters like earthquakes, cyclones, floods and tsunamis

South Asia Hydromet Forum (SAHF)



Meeting of South Asia Hydromet, Geneva .2018



**Meeting of South Asia Hydromet Forum, Kathmandu,
Nepal 2019**



Meeting of South Asia Hydromet Forum (Virtual), 2021

The World Bank (WB) is leading efforts to modernize Hydromet services in South Asia. National operations are underway in Afghanistan, Bangladesh, Bhutan, India, Myanmar, Nepal, and Sri Lanka. Considering the trans-boundary nature of weather and climate risks in South Asia, a need was felt for enhanced regional collaboration. Hence, The World Bank and World Meteorological Organization (WMO) organized the South Asia Hydromet Forum (SAHF) in September 2018 at Geneva. One of the aims of the Forum is to strengthen ongoing investments through regional collaboration. To further strengthen regional engagement, the second meeting-cum-workshop of SAHF was organised in November 2019 at Kathmandu. It aimed to strengthen regional collaboration on enhancing information sharing mechanism, improving forecasting skills with special emphasis on high-impact weather events, providing hazard information for risk assessments, prevention, response and recovery, and risk transfer across sectors, deliver user-oriented services in key weather-dependent economic sectors, and address common implementation challenges. SAHF III, organised virtually on November,2021, expanded the vision to strengthen the key elements of hydromet services value chain. It envisions support to evolving collaborative regional strategies to increase the use of ensemble predictions, impact based forecasting system and user oriented advisory services including agromet advisory services by bringing together a wide range of user communities, public, academia and private institutions. An important aspect of the forum is “learning from each other” which involves developing collective solutions to the meteorological and hydrological service delivery challenges that are unique to the region.

South Asian Seasonal Climate Outlook Forum (SASCOF)



SASCOF-11: Winter Season Maldives, September 2017



SASCOF-13: Winter Season Colombo, September 2018



SASCOF-14: Summer Monsoon Season Nepal, April 2019



SASCOF15: Winter Session & Climate Services User Forum on Water 2019

South Asian nations, supported by the World Meteorological Organization (WMO), have been conducting the South Asian Seasonal Climate Outlook Forum (SASCOF) since 2010. SASCOFs prepare consensus seasonal climate information on a regional scale that provide a consistent basis for preparing national level outlooks. Such forums also serve to interface with user sectors to understand and enhance the use of climate information as orchestrated and supported by the Global Framework for Climate Services (GFCS). Recognizing the fact that significant amount of rainfall, of crucial importance to agriculture, is also received in South Asia during the months from October to February; winter SASCOF sessions were initiated since 2015. During the winter months South Asian climate is influenced by both tropical (Oct-Dec) and temperate mid-latitude (Dec-February) circulation systems. North East Monsoon influences southern parts of South Asia, including peninsular India, Sri Lanka, Maldives and southern coastal areas of Myanmar. Northern parts of the region including Afghanistan, Pakistan, north India, Bhutan, Nepal, Bangladesh and Myanmar get influenced mainly during by extra-tropical activity dominated by Western disturbances. Seasonal forecasts for winter season therefore need to be issued at two stages - one during September/October for southern region and the other during November/December for northern region. The impact of seasonal weather forecast on agriculture is also explored in this forum

South Asian Meteorological Association

South Asian Meteorological Association is aimed to provide a platform among meteorologists of South Asian Countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan, Sri Lanka) to promote meteorology for larger good for society. The broad objectives of the society are:

1. Foster interaction amongst professionals working in meteorology and allied fields including agriculture in South Asia.
2. Advancement of meteorological and allied sciences in South Asia.
3. Communicate knowledge of such sciences both among the scientific workers and among the public through Citizen Science.
4. Application of meteorology and allied sciences for the socio-economic development of the region.

Theme: Ecosystem Restoration

5th June 2021

HAPPY WORLD ENVIRONMENT DAY

Let us create a good home to every creature of the Earth

South Asian Meteorological Association

Celebration of World Environment Day 2021

Since 1974 World Environment Day has been celebrated on 5th June. It is important to raise the issue of a healthy and a green environment. This year's theme for World Environment Day is "Ecosystem Restoration". The occasion reminds that Earth's ecosystem is still only known as human life friendly in this whole solar system. We must learn to protect this environment for all lives congenial for living and supporting a harmonious living on this planet.

Warm wishes on this special day to everyone.

CDHM Webinar Series - 12

Challenges in predicting severe weather over the Himalayas

Date: 17 June 2021, Thursday [०१६८३१११३]
Time: 05:45 PM - 07:20 PM NPT [UTC+5:45]

Register for the webinar at: <https://Lhy/STen>

For details: info@cdhm.tu.edu.np / info@samaearth.org.np

 PRESENTER Prof. (Dr.) Someshwar Das Convenor, South Asian Meteorological Association (SAMA) Former Professor, Department of Atmospheric Science, Central University of Rajasthan	 CHAIR Dr. Deepak Aryal Professor and Head, Central Department of Hydrology and Meteorology, Tribhuvan University	 CHIEF GUEST ANM (Ret.) Prof. Ajit Tyagi Chairman, SAMA Former Director General, India Meteorological Department
 MODERATOR Dr. Shrij Pradhananga President, The Small Earth Nepal (SEN) Asst. Professor, Tribhuvan University	 COMMENTATOR Dr. Samarendra Karmakar Former Director, Bangladesh Meteorological Department (BMD)	 COMMENTATOR Dr. Madan Lal Shrestha Academician, Nepal Academy of Science and Technology (NAST) Former Director General, Department of Hydrology and Meteorology, Government of Nepal

Proposed Activities of SAFOAM



Though World Meteorological Organisation (WMO), World Bank (WB), South Asia Hydromet Forum (SAHF), South Asian Meteorological Association (SAMA), South Asian Seasonal Climate Outlook Forum (SASCOF), have initiated some work in this region, still there was a lot of voids in agromet system in SAR and SAFOAM would

work to fill the gaps.

There are four major areas of SAFOAM activities. These are sharing of knowledge on advancement, dissemination and application of the knowledge of science of Agriculture Meteorology among the member countries followed by promotion of agromet research, interaction among all persons, bodies, institutions (private and/or state-owned) and industries and for better linkage between the between agrometeorological communities and policymakers

No service would be provided under SAFOAM as providing service is herculean task and might not be feasible; however, it would contemplate by creating knowledge platform which have value to the service provider, organising capacity building programme, education, research, dissemination of information especially by introduction of e-community radio, etc. as an extended arm that become role model for the SAR and ultimately prepare the framework that could be modified by the intermediaries and user group. As research and climate change issue were very important in South Asia particularly in the present day of environment, it is required to put more thrust on climate change and policy issues which would directly help the respective government.

It has been agreed that special attention would be given for multichannel dissemination system along with AI & ICT Models for real time communication of information to the farmers including use of satellite data on drought monitoring and also preparation of agromet advisories based on sub-seasonal forecast, organisation of FAP and also share the success stories in SAR to create interest among the farming community on the necessity of these services in the member countries. Besides, different training modules particularly on weather beneficial and impact on crop; soil moisture, evapotranspiration irrigation, management of crop which might be imparted to the member countries.

At this juncture and challenges, three things are very critical & important under SAFOAM activities. These are (i) organisation of information of weather climate, crop, soil & pest data from diverse sources and driving the data for the decision-making process system; (ii) organising hand holdings for the countries, where operational AAS in infancy stage, for setting up agromet system in a relatively short time by grasping entire information on weather, climate, crop, derived information like crop weather relationships etc. (iii) This would be done through using tools in semi-automation mode deriving data, knowledge resources.

First priority would be given to gather the information from the different real stake holders/ communities for the actual need on the ground. For this expert team in SAFOAM would prepare the comprehensive questionnaire, survey & collect the information on need, gap areas from the member countries that would give significant boost in the activities of SAFOAM. Based on the end users, requirement, it is required to share that information to the other committee members and designate experts & resources to address these issues in terms of application.

at first identify the thrust areas on research and for that we would focus on the capacity building programme to meet the thrust area and formulate effective programme which would be made more interesting to the people in this region.

Another important area is the coproduction particularly in respect of collaboration between meteorologist and agriculturist at policy level, scientific and implementation level. Still there are some countries in South Asia, the operational agromet services either has not started or at the initial stage; more discussion would be made by the meteorologist and agriculture experts with the respective Governments to convince the need of the services under the climate variability and projected climate change. Besides, both meteorologists and agriculturists would jointly prepare road map on development of strategies, need for specific meteorological and agromet products and finally the implementation strategies for operationalization of agromet advisory services considering the inter-departmental coordination, understanding and institutional arrangement and using different tools especially the analogue system and kinds of weather and corresponding agromet advisories in the past for preparation of agromet advisories in SAR.

Besides, all the members of SAFOAM would communicate the large population of poor farmers in South Asia that they were always welcome to share the feedback so that it would be possible to share the seamless operational

decision in farm management. Also, every agrometeorologist in South Asian Region would emphasis for IMS i.e., Improved Agrometeorological Services. They need to cooperate actively with the Agriculture Ministry, Scientists in Agricultural University/organisation and also how we can improve agrometeorology. There is a need to identify agrometic analog across different countries in SAR as this is required for any country to interact the kind of people and kind of areas of interest for better understanding.

A number of countries in South Asia have initiated project on climate change adaptation in agriculture. Such initiative may be shared with other countries for better livelihood and food security of farmers in SAR. Ultimately SAFOAM may share and contribute its inputs on Strategic planning/vision for the Climate Change Adaptation in agriculture in South Asia to in IPCC Reports. Taking the important aspects of the drought manual and other information of the respective country, drought monitoring in different countries in SAR is possible. The work done by the International Water Management Institute, Sri Lanka which are doing good work in this regard and IWMI may be taken in board in drought monitoring in South Asia.

Implementation Strategies for the Different Activities of SAFOAM

Capacity Building



Continuous support is required to provide capacity building under SAFOAM. As far as the capacity building is concerned, need for each country would be assessed and initially some elementary programme might be initiated. Initially the gaps, farmer's need etc., particularly from the prospective /representative farmers as per the questionnaires prepared by the experts would be obtained.

As the agromet advisory services involve manpower at different level i.e., meteorologist/agriculturist, intermediaries and farmers, capacity building programme would be organized at different levels with appropriate modules so that better communication skill among meteorologists and agriculturist, farmers would be developed. Capacity building programme for the top-level officers, including bottom level officers, particularly for preparation and dissemination of agromet advisories by citing the on-going activities on agromet advisory preparation in India and Bangladesh is essentially required in SAR. More stress might be given to the capacity building for the rural farmers especially woman farmer related to climate change.

Under the combined efforts of SAFOAM, SAMA & Agromet Association in India, it is possible to organise training programme and other activities. Initiatives would be taken to rope those who retired from service and might be requested to provide training voluntarily. Besides, effective mechanism might be built up for the people who are outside and inside the Government.

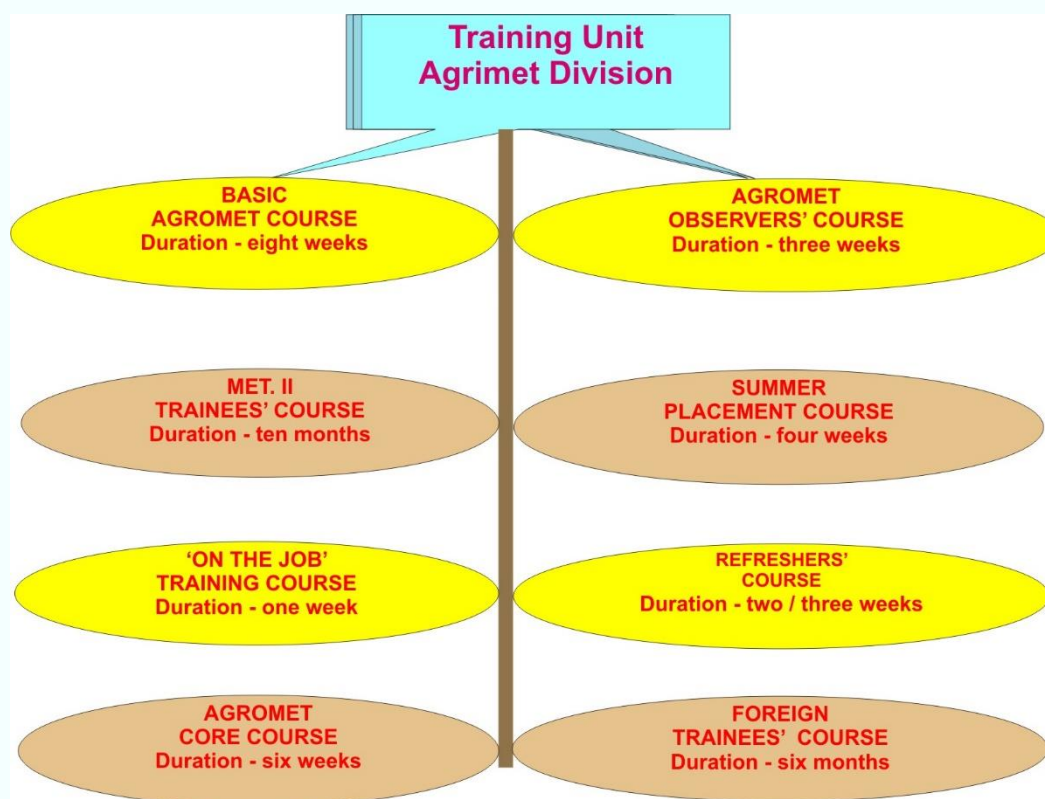
Efforts would be made to arrange some capsule courses for the representatives in South Asia. Experts from India and other countries in consultation of international experts could prepare capsule courses for the representative farmers in South Asia Region. Various representatives of SAR need different agromet information, experts from this forum might share this information and also even would visit to these countries and help them to organise the roving seminars. In addition to organise annual meeting, seminars, scientific interactions etc, there is need to create a mechanism so that this forum could assist in weather and climate services for the farmers in South Asia.

Proper training would be given to handle and reduce the impact of the frequent extreme events on crops. Moreover, capacity building programme would be arranged for ground and field workers to translate the new agromet and remote sensing products. Besides, the, stakeholders, farmer, extension workers who are involved in adaptation measures would be trained. Also, training is required how these different weather products, agromet products, product matrix could be used in operational Agromet Advisory Services. It is required for correct interpretation of different agromet products including satellite products in the preparation of agromet advisories by those who are involved in preparation of crop and location specific agromet advisories. The faculty members of Agricultural Universities, extension officers of Government and Agricultural Universities and others concerned would be aware of agromet products and its utilisation for agricultural management, agricultural development and critical operations in the field condition. Initiatives would be taken on capacity building on the generation and using satellite data in agriculture, involve academia in exchange programme on research and development, use of satellite information in livestock management, satellite derived high resolution soil moisture, use of remote sensing in weather-based insurance.

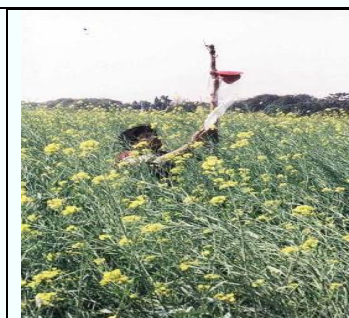
In India, comprehensive training programme for 21 days are arranged at different levels covering the entire spectrum of agromet advisories from weather forecast, its translation, tools, to dissemination to feedback, economic assessment etc This training programme consists of different modules. As per the need of the member countries these training modules would be selected. Training would not be given in one goal; on the contrary in fragmented manner for those who are at the initial stage; simple module on forecast, observation and translation of the same into agromet advisory might be chosen. Then after having the filed experience, training with additional modules might be taken up. Training on weather smart advisories to location specific undergraduates is also included under the capacity building programme of SAFOAM. Number of training manual, capsule course at different levels is available in India, Bangladesh, the same would be shared with the other countries as per their need. Transfer of knowledge and help in capacity building programme on smart agriculture, climate change adaptation plan under digital platform might be initiated.

. Some of the strategies on capacity building programme are as follows.

- Training Need Assessment would be conducted in all member countries prior to arrange capacity building programme.
- Knowledge transfer among member states and generation of quality manpower through various training programs.
- Capacity building programme on manpower, infrastructure, data base, agromet advisory services would be organised country wise depending on the strength & weakness and priority basis.
- Capacity building would not only be given to agrometeorologist, but for farmers and industries govt officials, extension officers, service providers.
- Identify the groups and voluntary scientists, agrometeorologists retired and working experienced agrometeorologists who could really help to fill the gaps so that SAFOAM can help in improving the capacity of those groups who will ultimately supports other groups and this would be taken as top priority.
- More stress would be given on capacity building in practical form to those countries where it is lagging very much.
- Professional training, particularly on subjects specific to the region delivered by experienced professionals.
- Association of Agrometeorologists in India and similar association/forum/society would be involved in providing training programmes.
- Prepare a short-, medium- and long-term calendar for arrangement of capacity building programmes.
- Capacity building programmes through Farmer Awareness Programme, Climate Field School etc. would be arranged.
- Capacity building of the mountain communities in relation to improving their livelihood through climate-smart agricultural practices (integrating crops and livestock)



Research



Basic research in agricultural meteorology is an important part of the group of basic support systems. Applied agrometeorological research has played an important role in developing many of the other supportive tools. Many suitable research findings or products based on such findings are not transferred at all to the farmer's field through extension. Too many of the products of research lie idle and will never be used supportively. Agrometeorological research as a support system particularly needs constant regional, national and local prioritization. As long as farmers do not get their needs addressed by extension services based on research output, the latter remains limited to support systems only. Agromet research is not strong in SAR and thus more initiatives/improvements are required in SAR. Under the Research programme, special attention would be paid to use of satellite information in product development as an effective tool for preparation of agromet advisories and hill development utilising different agrometeorological information and location specific products. Some of the recommendation on research programme are as follows.

1. To encourage and promote research in science of Agricultural Meteorology and related disciplines.
2. Promote collaborative research in agrometeorology involving agricultural universities on generation of new agromet products, climate change, climatic variability coordinated products drought, flood and other

extreme events may be taken up.

3. Under the collaborative research programme, more stress may be given to research on virus, bacteria, fungi and weather.

4. Knowledge transfer and guidance in agromet research would be the integral part of collaborative research programme.

5. Climate and climate change issues and its impacts in agriculture still not addressed adequately in national and regional level would be considered.

6. More work in research and development would be for use of more information on weather and climate so that true agromet advisories can be issued to the farmers.

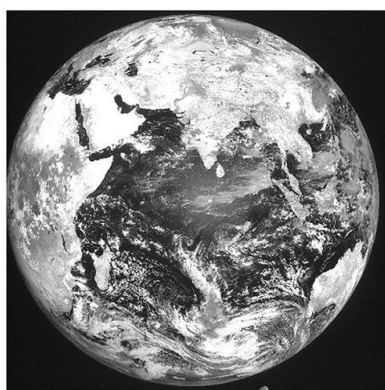
7. Assist in preparing research project and arrangement of funding from different national and international funding agencies.

8. Encourage young scientists by arranging some funds to work on the subject of agrometeorological research.

Remote Sensing



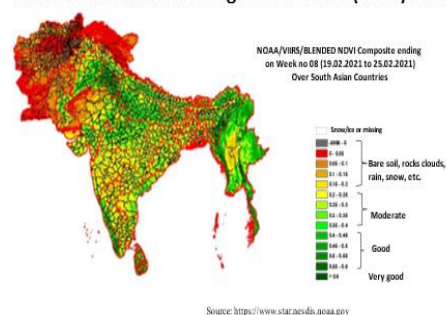
INSAT-3DR



INSAT-3DR
15th Sep 2016, 11:30 hr. IST

IMAGER
SWIRBand

Normalised Difference Vegetation Index (NDVI) for SAR



At present the data generated from geostationary and polar orbiting satellite. Polar orbiting satellite is used for primarily crop discrimination, crop acreage etc. and geostationary satellite generate meteorological products and also products for agricultural sectors. Manual intervention & automation required to generate quality information and made useful for preparation of agromet advisories. NDVI data from INSAT CACCD is used for preparation of agromet advisories. At present number of products like maximum and minimum LST, NDVI, predicted NDVI, surface soil moisture is available. These products could be used for irrigation advisories, forewarning of pests & diseases incidences. INSAT coverage is all over South Asia. Govt of India's has encouraging policy on sharing data with the neighbouring countries. However, validation of the products from INSAT 3D & INSAT 3R for use to reduce the error for effective use.

There is a large gap, need in the area of application of satellite and satellite derived information in agriculture. At this stage there is need to develop the strategies and road map to use the satellite product in agriculture in SAR looking at the priority. First priority would be what we can launch immediately considering the different level of use of remote sensing in the respective country followed by the capability to use remote sensing products and the remote sensing products skill level. Initially i.e., in phase 1. identify the remote sensing products/data which are globally and freely available and can be shared with SAR. It is required to prepare the list of the products and concurrently put and display in proposed web portal of SAFOAM and then it would be recognised worldwide. Add value in phase two and three. In phase two, enhancement of capacity building programme would be taken up. In phase three, research work as might be taken up. Paddy is a good suggestion for working with remote sensing data in SAR initially. The proposed priority works, challenges and ultimately the road map and works would be taken up at different stages of SAFOAM activities.

Today it is possible to use the high-resolution space products after proper massaging with the ground observations. Under this forum, one of the important tasks would be to generate products for entire South Asia and place in seamless digital platform to prepare agromet advisories and corresponding AAS bulletins. There are three challenges on the use of remote sensing products in agriculture. These are (i) identify and enlist the remote sensing products, (ii) preparation of quality of products using different techniques and using ground truth, (iii) establish the mechanism for hand holding to the user community to use these products for preparation of more robust agromet advisory bulletins. The satellite products may be generated daily, weekly and also other temporal scale as per the need of the user community. In addition to the products like NDVI, VCI, TCI, PET, Insolation, soil moisture information from SMAP could also be included along with MODIS, NOAA, AWIFs data and other data at high resolution scale may also be taken into consideration for development and display under SAFOAM initiative. More challenges would be on the development of institutional mechanism along with good Standard Operating Procedure (SOP). for process-based simulation of remote sensing products. That a proper mechanism would be worked out how training programme for the representatives of SAR could be organised shortly without much hindrance involving SAC, IMD and other organisations. There is need to develop common strategy on availability of satellite data and also as far the requirement of advisory, a few indicators may be chosen to begin with. to take up and focus on some common products available and which can serve the farmers requirement in SAR.

INSAT products are freely available to research purpose and consumption by the public organisation also. The irrigation advisories taking consideration of satellite information to replace supply-based irrigation to demand based irrigation as more than 50 per cent water could be saved by this approach. demand-based irrigation advisories based on graphical interface technique, generalised crop coefficient, local information and development of Apps connected to server. There is potential of satellite information in forewarning of pest and disease incidence by citing some experiments she carried out some field experiments using reflectance data from handheld instruments and also such methodology might be applied to control fall armyworm incidence in maize crop. more on the operational aspects with the readily available information followed by display in appropriate platform and capacity building.

Satellite information might be very useful on preparation of fodder map and type of fodder map especially green fodder assessment. This would help in livestock management involving logistic also. Besides, utilisation of satellite information on pasture, dairy, forestry etc would be explored. This subject would be as one of the important activities of SAFOAM.as the subject is interesting and emerging in South Asia. The weather insurance supported by the remote sensing data and yield forecasting using weather and satellite information would be useful in SAR.

Request would be made to the representatives in SAR to send their requirements in respect of present status of remote sensing data, access of remote sensing data, capability of use the data, training requirements, success stories etc. Some of the recommendation on application of remote sensing on operational agrometeorology are as follows

1. identification of the common & skilful satellite products/indicators, which have proper value and usages in agriculture would be made in South Asia.
2. Display of all the products/indicators in South Asia would be made on digital platform.
3. Mechanism would be developed to get access the satellite products/indicators by all the countries in South Asia obliging the data policy among different member countries.
4. Promotion of exchange programme on Research and Development especially on irrigation advisory, forewarning of pest and disease, crop yield forecast, weather-based insurance etc.
5. Explore to prepare fodder map, types of fodder map for green fodder assessment utilising the satellite information. Usability of satellite information in dairy, pasture, forestry sectors also may be ventured.
6. Documentation of satellite product catalogue, sources, links, data policies.
7. Identify high, moderate and low priority implementable work elements.
8. Formulate strategy and mechanism for training and student exchange.
9. Sharing of methods of quality check of satellite and observational data for its proper use.
10. Initiatives on product generation including satellite products for South Asian Region and display in the web portal of SAFOAM.

11. As far as application satellite technology is concerned, arrange to provide technical advisory for preparation of good agromet advisory.

12. Prepare some proposals in niche areas for international funding.

Hill Development



Significant areas in South Asia are in the hilly region and the challenges in providing the services in hills, compared to plain lands, are high. The science of agrometeorology and operational services in particular in plain land were comparatively better position in present days than the hilly region. Within the hilly region there is diversity in weather, diversity in cropping pattern, etc. In the hilly areas, there are number of constrains like slope in the hill, insufficient weather observation, maintenance of observatories, large variation of temperature along the slope within a short distance, frequent extreme weather events, landslides etc. Special attention needs to be taken up to handle these issues in preparation of crop and location specific advisories in hills. There is also need for dense observational network as inadequate observation network still persists in some of the member countries in South Asia Region (SAR).

One important point to take care of in the hills is micro climate-based advisory for which micro climatic studies are a must. Adoption of model villages for pest and disease app development and advisory based on such inputs can also be beneficial as a large portion of produce is lost due to diseases and pests. Studies on modification of microclimate in the crop field and animal houses are very important aspects not only for identifying better management practices of crop for higher productivity, but also for effective management of pests and disease management. It is to be mentioned that there are number of examples area available of controlling insects-pest and diseases through modification of crop microclimate without applying any chemicals.

Here satellite information may serve efficiently. Remote sensing may solve a number of problems under such inadequate infrastructure facilities in hills. Customized agromet products including the satellite products particularly in hilly areas would be useful for providing crop and location specific agromet advisories at very high-resolution scale in hills. Thus, special care would be taken to record the ground observation which are used as a component in preparation advisories for the farmers in the hills. Here satellite information may serve efficiently. The idea of increasing the number of weather stations (at least one rain-gauge and on SSS) to understand local variation of weather and climate in hill areas is essential as weather/climate varies with a very short distance. Because of difficult terrain, dissemination of agro-met advisory is challenging in hills particularly through extension services. Along with the conventional approach and along with mobile phones for dissemination, some innovative approaches in this regard might be thought off e.g., introduction of community radio in dissemination of information in local languages in clusters of villages and capacitate large number of people at community level as it needs minimal cost. Formation of WhatsApp groups of crops specific, block level farmers have also been also useful.

Besides, following areas have been taken into consideration to improve the operational agromet advisory services in hills.

1. Development of forewarning models of pest & diseases is very important in hills. Pest weather relationship studies have not been done sufficiently; however, this aspect is very important to understand behaviour of

insect-pests and diseases in relation to prevailing weather conditions. Such understanding would be beneficial for developing useful forewarning models. Developing thumb rule/forewarning models in terms of weather parameters on development of insects-pest & diseases may be very useful for quality agromet advisory services.

2. *Crop-weather relationship studies have not been done sufficiently till date for different crops in a locality in hills. However, such types of studies are very important not only adoption of better crop management practices for increasing productivity of the crops both in terms of quality and quantity, but also generating quality agromet advisories.*
3. *Identification of the location specific weather hazards/aberrations/extreme events and prepare contingency crop plan according to the prevailing weather constrains in that locality, as well as also by considering experienced/observed changes of weather and climate of the locality.*
4. *Special attention needs to be taken up to handle the diversity in weather, large variation of temperature along the slope within a short distance, frequent extreme weather events, landslides diversity in cropping pattern, etc in preparation of crop and location specific advisories in hills.*
5. *There is need for dense observational network as inadequate observation network still persists in some of the member countries in South Asia Region (SAR). Full utilisation of remote sensing data/information/products may be explored especially for the unrepresentative area in respect of weather observation for preparation of agromet advisories.*
6. *Development of customized agromet products for hills would be made.*
7. *Development of forewarning models of pest & diseases & crop-weather relationship & promotion of multidisciplinary research in agrometeorology in hills would be made.*
8. *Promotion of micro climate-based advisory based on micro climatic studies would be made.*
9. *Initiative on mutual collaboration to operationalise agromet advisory services in hilly areas of South Asia.*
10. *Micro-level research in hill areas and improvement of weather data collection network.*
11. *Development of forewarning models of pest & diseases in hills for quality agromet advisory services.*
12. *Development of crop-weather relationship studies for different crops in different localities in hills.*

Education



**MOU between Ministry of Agriculture
& Agricultural University**

SAFOAM would encourage the curriculum development on agriculture meteorology under Department of Meteorology of the Universities and Agriculture Universities in South Asia and proper strategies of education for the new entrants from the member countries would be given importance. Basic subjects on agrometeorology would be included along with the subjects of country specific under the educational programme. It would be good to bring together experts from the Agricultural Universities and prepare module/curriculum in Bachelors' level on

climate change, weather and climate knowledge.

Before preparing the education programme for any country, it is essential to know the input materials readily available and what is the present level of education and also what types of farmers along with the need of the country and who would be the participants and ultimately what types of output are expected including from the farmers of that country. Education programme would be prepared based on the need of the country from pre to post degree levels. Webinar-based education programme would be arranged as number of experts are available under SAFOAM programme. It would be prudent to arrange 30-40 lectures including basic subjects of agrometeorology along with country specific subjects through the training programme.

Besides, the subject of agrometeorology would be included in the Environmental Science as only Botany is included at present. As climate change, water use, adaptation, agrometeorology would lead to the as only better management of agriculture and in turn increased and sustainable food production in South Asia, more stress would be provided in education programme. It would be good idea to include the subjects like selection of seed and post harvest technology in the education programme. Under the present circumstances, series of webinar for school to higher level by the expert would be arranged. to create interest for the subject of agrometeorology and its importance in the present & future especially under climate change scenario. It is also planned to prepare needful and attractive capsule courses for the agricultural scientists for special aptitude for agrometeorology.

SAFOAM would reviews the requirements for training, education and extension in in agrometeorology in developments in higher education programmes, in training for agrometeorological technicians, and at other vocational levels where agrometeorology is involved. This has been done only sporadically and not very explicitly at the level of end-users (for example farmers in field classes). It also encourages the development of teaching materials for use in workshops and seminars and by visiting lecturers. While the scientific principles are the same in all countries in South Asia, however, the potential applications and the conditions under which they are used vary greatly among countries in different climates and at different stages of development. This also applies to education, training and extension to put these applications into effect. Training programmes at all levels must therefore be adapted to national and regional needs (WMO, 2000). In terms of recent operational efforts, this includes developing extension agrometeorology around the establishment of agrometeorological services.

Meteorology/agrometeorology subjects would be included from the school level. There is need to include the course on weather, climate & agriculture even from the school level so that importance of the subject would be understood by the prospective farmers in different sectors of agriculture i.e., fishery, livestock, poultry and this would help us immensely in future.

As far as education capsule course at school level is concerned, education committee under the forum might look into these aspects. In addition to that agrometeorology course would cover the selection of seed to post harvest and storage of crops. Some of the recommendation on educational programme are as follows.

- 1. SAFOAM would take initiative with the respective Government agencies and Agricultural Universities in South Asia to promote & support, to open up Agromet Course in agricultural universities in the member countries of South Asia.*
- 2. Prepare the curriculum in the science of Agricultural Meteorology and related disciplines.*
- 3. There is need to spend considerable time planning the modules and make several of them available through online resources.*
- 4. . Short course on agromet bulletin preparation, dissemination, agromet research for enhancing agrometeorology in South Asia.*
- 5. SAFOAM would provide human resources as lectures or professors so that such initiative would be taken up to offer degree in meteorology or agrometeorology in universities in South Asian Countries.*
- 6. Support to arrange Post-graduate and PhD studentships*

Information Communication Technology (ICT) & Dissemination of Information



Recent technology could be used to disseminate the information to the farmers at the faster mode Proper use of state of art technology especially artificial intelligence in preparation and dissemination of agromet advisories in faster mode. More emphasis might be given on different ICT technologies, WhatsApp, SMS mobile apps in dissemination of Agromet Advisory to the farmers and other user community. Two-way communication in agromet system in the state of might be taken up in SAR. Preparation of SOP on information dissemination, multi-institution collaboration, two-way communication, socio-economic benefit etc. More weightages would be given on use of ICT in dissemination of information. The value of the information was usually determined by the question rather dynamic questions received from the user community. The value of the information communicated to farmers and also multi way of communications from all those directly or indirectly involved in agromet advisory services.

Introduction of e-community radio in dissemination of information in local languages in clusters of villages and capacitate large number of people at community level may be encouraged as it needs minimal cost, e-community radio for dissemination of information and other related activities would surely help the farming community. However, lacuna and needs in member countries would be understood first and accordingly the related information might be shared and this would be used after proper validation including organising training programme to effective use such information in the respective country. Though there is some limitation, community radio for dissemination of information would be used as a secondary channel of information to fill the gaps along with the other modes of dissemination. Thus, e-community radio concept could be a viable solution as its low cost and packet size is not so big and additionally number of activities like FAQ, feedback, chat system could be performed.

ICT is an enabler. Two pieces of ingredients of ICT are technology and people. ICT tools would be used for capacity building programme which again an area of development of tools

There is need to improve ICT capacity in dissemination of information as well as developing specific bulletins in member countries in South Asia.

The role of ICT is both information production and information dissemination. Though initially the dissemination was relatively slow due to non-advancement in ICT, but today there is a sea-change in dissemination of information in urban and rural areas due to huge progress in ICT in dissemination particularly through different types of upgraded phones including mobile phones and communication of information through SMS, touch screen etc. These days there is a substantial increase in tele density in number of countries in South Asia. As on today penetration of information is there and it reached to rural areas; however, there is need to better products and contents in the information usable to the farming community. Quantum communication is coming very fast and route with multiple kind of information, interacting with each other and ultimately reach out to user community. It is expected that big technology like artificial intelligence, ML and others would be used extensively for next two years; however, we would be ready to use it. Huge kind of opportunity would be available and we would ready for

that and grab the opportunity. Some of the recommendation on Information Communication Technology (ICT) & dissemination of information programme are as follows.

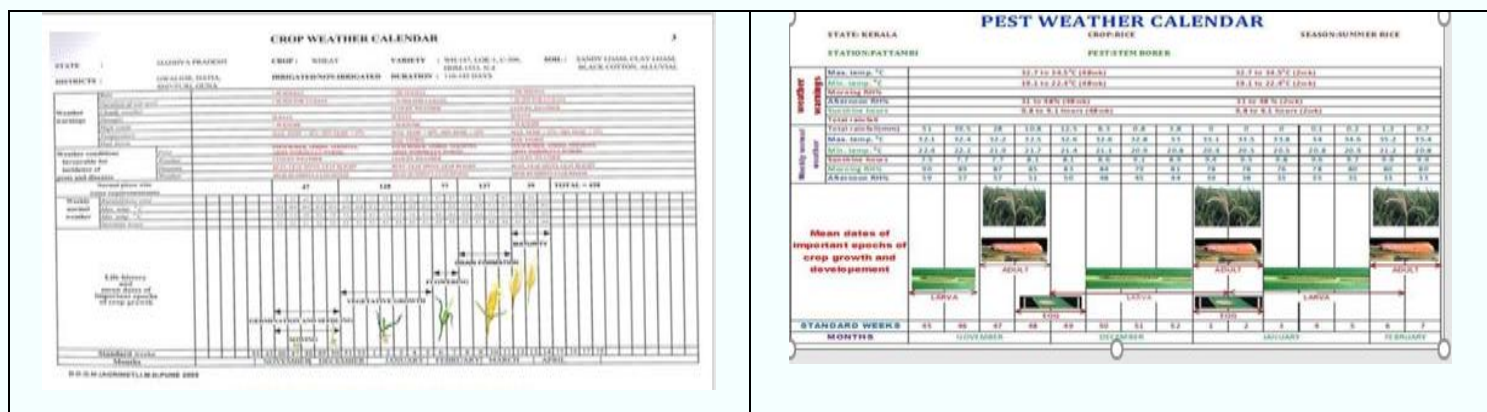
- Initiatives to be taken up for enabling required ICT to the various member countries in South Asia.
- Use of such technology would help to access, analyse the data and various information for taking decisions in formulation of agromet advisories for the farmers.
- It is essential to access, analyse, comprehend and take decisions on the service providers in different NMHSs in this region using ICT.
- ICT in Amazon and Bhuban initiatives of Indian Space Research Organisation (ISRO) would be explored.

• *Regional & Global Cooperation*



- Appropriate mechanism would be developed to get the support and recognition from the governments in South Asian countries as Director General of Meteorological Departments of the member countries in South Asia are also already supporting this initiative. Besides, recognition from Ministry of Agriculture, Ministry of Meteorological Department are desirable. Even international organisations like FAO, WB, WMO's recognition would be added advantage.
- Also, link could be given to MODIS, FAO, other organisations, international bodies, organisation, BAMIS portal of Bangladesh. SAFOAM could be the member of Group on Earth Observations Global Agricultural Monitoring Initiative (GEOGLAM) which are issuing qualitative information of monthly crop condition through crop monitor website like exceptional bad, good and other categories. Some of the proposed initiatives on this area are as follows.
- Foster regional collaboration and cooperation in to science of Agricultural Meteorology and allied sciences and support the efforts of national Meteorological, Agriculture, Hydrological, Horticulture, Veterinary science and Animal husbandry, ICAR, WMO, World Bank, ADB, CAGRI, IPCC, FAO and other international entities working in the South Asian region.
- Linking with regional projects like RIMES, ADPC.CARE may be made. All the regional projects are expected to support as it is regional initiatives and these regional projects may synergise the activity of SAFOAM.
- SAFOAM & SAMA would work together to address all the relevant regional activities in collaborating mode and use Atmospheric Science & Ocean Science for the use of common man.
- SAFOAM would use the SASCOF to build the capacity of different NMHS in building and issuing seasonal & sub-seasonal and impact-based weather forecast for the farmers in South Asia.
- For carrying out research programme on interdisciplinary science involving physical science, earth science and biological science, a national or international institute on agrometeorology may be set up. Such recommendation may be made to all the SAARC countries through SAFOAM platform. As setting up of such institute may not be an easy task at this stage of the forum and existing SAARC system but such concept may be included or explored with the in-built existing SAARC system.
- Request may be made to World Bank to allocate an extra day or session for showcasing SAFOAM activities in the next South Asia Hydromet Forum (SAHF) programme.

Monitoring



As a knowledge platform, SAFOAM would explore sharing of mechanism for monitoring of agrometeorological parameters, crop-weather relationship, pest-disease-weather relationship, development of tools and products which relate to agrometeorological data, weather forecast and other specific agromet deliverables. Besides conventional monitoring, monitoring of drought, flood and other extreme events including soil moisture, crop conditions would be considered. Monitoring of crop condition (soil moisture stress & pest & disease attack) using satellite observations would also be done.

Role of Agrometeorology in Agricultural Marketing

It has been established with fair degree of accuracy the role of agrometeorology in agricultural marketing system and its rapid transformation across the country in SAR and ultimately huge potential of agricultural market for national interest. This is new and emerging area. It is required to capacitate the service provider in the process data for farmer and other users and linking to market. Private companies would be roped into the system. A national policy might be framed on Public Private Partnership (PPP) mode for greater participation of private sectors in this system so that the objective of the government of the member countries would be fulfilled. Additionally, the use of manpower, knowledge pool, dissemination technology including touch screen could be used to communicate the information in local languages and their own languages from producers to the users.

Publication, Awareness Programme & Institution of Award

SAFOAM 1/2021



SAFOAM NEWS LETTER

South Asia Forum on Agricultural Meteorology

This Issue.....

- ✦ Message from the president
- ✦ Back ground of SAFOAM
- ✦ Objectives
- ✦ Social Media for SAFOAM
- ✦ Founding members of SAFOAM
- ✦ Advisory Board members
- ✦ Executive Council members of SAFOAM
- ✦ Country chapters
- ✦ National members
- ✦ Formation of different Core groups under SAFOAM
- ✦ Road map & Implementation strategies of SAFOAM
- ✦ Initial feedback from countries in South Asia Region
- ✦ Activity plan for 2021-2022
- ✦ Agro-meteorological Activities at different South Asian countries
- ✦ Annexure -1

Launching of South Asia Forum on Agricultural Meteorology

South Asian Forum on Agricultural Meteorology (SAFOAM) was launched on 9th February, 2021 to strengthen regional cooperation in agrometeorological advisory services of the member countries in South Asia. Sixty-two members from seven countries namely, Afghanistan, Bangladesh, Bhutan, India, Myanmar, Nepal and Sri Lanka participated in the meeting. The aims and objectives of the meeting was elaborated by Dr N. Chattopadhyay, President, International Society for Agricultural Meteorology & Former Deputy Director General, Agricultural Meteorology Division, India Meteorological Department. Elaborate discussion was made on different thematic areas under the moderation of Dr.L.S.Rathore, Consultant, The World Bank & Former Director General of India Meteorological Department. At the end, patronage address was given by Dr. Shailesh Nayak Director, National Institute of Advanced Studies & Former Secretary, Ministry of Earth Sciences, Govt. of India.



Dr. Shailesh Nayak




Dr. L.S. Rathore




Dr. N. Chattopadhyay

SAFOAM-3/2022




Information Brochure


South Asia Forum on Agricultural Meteorology




Harvesting of Paddy before flash-flood warning in Bangladesh




Sensitisation Programme on Agrometeorology in Afghanistan




Crop Damage due to Extreme Events in Bhutan




Capacity-Building Programme in Myanmar




Crop Simulation-Modelling Training in Nepal




Rice Cultivation in Sri Lanka



Weather-monitoring device installed near an agricultural field in Pakistan



Maldives Meteorological Services



Feedback from Farmers in India

SAFOAM would arrange to publish e-newsletters periodically reporting its activities and special news related to Agricultural Meteorology of the member countries so that meaningful development & activities would reach to the large number of persons. Arrange to publish suitable statements, press releases, posters, pamphlets, books, periodicals, brochures, etc. on topics relevant to the objectives of the Forum. The proceedings of Annual General Body Meetings and the papers presented at such meetings would be published at the discretion of the council in such form as the council may decide. Other areas of works include:

- Organize e-conferences, webinars, celebrate special days such, the WMO day, World Environment Day, etc. together with the member countries for creating awareness among the people.
- Create awareness and appreciation for science of Agricultural Meteorology and allied sciences, among all sections of the society.
- Award Fellowships and awards to deserving persons for making significant contributions to the aims and objectives of the forum.
- Instituting awards for best MSc/ PhD thesis for promoting education and best research paper awards for promoting research,
- Awards to encourage young generation for recognition of their outstanding contributions made in the field of Agricultural Meteorology and inspiring young researchers/ scientists of the member countries. Awards would also be there for Institutional encouragement.

Way Forward

SAFOAM would develop framework on the Agromet Advisory Services in SAR and act as knowledge platform and ultimately going to do such areas which has not been done/doing before by the operational agencies and nobody has touched yet.

This forum would supplement the activities to be taken up by the member countries with the available knowledge pools and finance, if possible. It is proposed that initially to identify the low hanging fruits and ride on kind of transformative process which can be done or happen with the existing data available freely in public domain and our disposal would be knowledge pool. It is required to generate business model, generate information marketable and ultimately generate revenue as well. It is also desirable to identify plethora of problems but select few things important to farmers and intermediaries and Govt to propagate it as ultimately govt wherefrom we seek support. Pointwise brief action points under SAFOAM are given below.

Capacity Building

- 1. The status of agromet services in South Asia varies in each country. Strength and weaknesses in terms of providing agromet advisory services in each of member countries would be identified. SAFOAM can assist in providing expertise to train human resources, developing infrastructure and data base and launching agromet services to all stakeholders, agrometeorologists, farmers, industries, government officials, extension officers, service providers, etc.*
- 2. As SAFOAM to function as a knowledge platform, group of agrometeorologists have volunteered to provide support to identify tasks for developing products and services, assess and improve the capability to execute these tasks.*

Education & Research

Promotion and providing support in designing syllabus, etc. to start Agromet Course in agricultural universities in the member countries.

- 1. Collaborative research involving agricultural universities on climate change, climatic variability, drought, flood and other extreme events would be taken up.*
- 2. Climate and climate change issues and its impacts in agriculture would be addressed at national and regional levels.*

Linking with Regional & Global Project & Initiatives

- 1. Linking with regional projects like RIMES, ADPC, CARE to be made. SAFOAM activities to be synergised with these regional projects.*
- 2. SAFOAM and South Asian Meteorological Association (SAMA), SAHF, SASCOF to work together to address all the relevant regional activities.*
- 3. A National or International Institute on Agrometeorology would be set up, along with national institutes in each country, to carry out research programme on interdisciplinary science involving physical science, earth science and biological science. This recommendation to be conveyed to all the Member countries.*

Use of Satellite information

A detailed documentation to be carried out describing utilisation of satellite data, quality checks, generation of and services. Besides, the products and services are to be provided through web portal of SAFOAM.

Funding

Possible funding from international donors like DATATRUST, UNDP, FAO, USAID, WB, Norwegian Embassy, Swiss Development Corporation, would be explored.

Enabling ICT in AAS

Initiatives to be taken up for enabling required ICT to the various member countries in South Asia. Use of

such technology would help to access, analyse the data and various information for taking decisions in formulation of agromet advisories for the farmers.

Gap Areas

It is necessary to address issues related to data, products and tools, monitoring mechanisms availability of manpower and capacities and provide solutions.

Regional Monitoring Mechanism

A mechanism for monitoring of agrometeorological parameters, crop-weather relationship, pest-disease-weather relationship, development of tools and products which relate to agrometeorological data, weather forecast and other specific agromet to be developed. Monitoring of drought, flood soil moisture, crop conditions would be taken on priority basis.

Regional Policy

Development of regional policies for implementation of different activities of SAFOAM by respecting to the sovereign nations and laws of land with framework.

Development in hills

A special emphasis would be given to operationalise agromet advisory services including micro-level research in hilly areas of South Asia.

Publication

12. SAFOAM to initiate a publication of Newsletter and others to inform all stakeholders about periodic development and activities of member countries.

The initiatives so far taken under the knowledge platform of SAFOAM is encouraging and all the proposed strategies mentioned above would surely going to serve the farming community in SAR. Besides, the growth of discipline of Agrometeorology in all the member countries of South Asia and SAFOAM would serve as a MODEL for regional cooperation in the rest of the world.



Weather Observatory in Afghanistan



Manned Class A Station in Bhutan



Observation of radiation in experimental field in India



Automatic Weather Station in Pakistan



Weather Station in Nepal



Soil moisture measurement in Bangladesh

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