Expert group Meeting
On
G-Wadi Meeting and Flash Flood Risk Management

*September 24-27, 2010*

October 2010
Preface

Flash floods are one of the most devastating natural disasters because of their rapid occurrence, little lead time for warning and tremendous amount of water flowing with high energy. Flash floods often occur in isolated remote mountain catchments, where there are few, if any, institutions equipped to deal with disaster mitigation and where relief agencies are either absent or have limited presence and capacity to manage the results of natural disasters.

Recently during 2009 and 2010, different parts in the Arab region were subjected to heavy rain storms leaded to flash floods. People were killed, power lines were knocked out and roads were destructed in Aswan and Al-Arish cities in Egypt, Jeddah city in Saudi Arabia and Gaza in the Palestinian Territories in addition to many other areas in the region.

Flash floods risk assessment forms the core of the disaster risk management process and results in the identification of potential risk-reduction measures in the Arab region. The integration of risk assessment into the development planning process is highly needed to identify actions that both meet development needs and reduce risk. Identified risk-reduction actions should be incorporated into development policies in the Arab region.

It seems that there is a lack of adequate understanding of the processes causing flash floods and knowledge of flash flood risk management measures at institutional levels. Building the capacity of those who are working and dealing directly with flash flood will help to reduce flash flood risk in the region.

Within the framework of the IHP activities in the Arab region and with special focus on Wadi hydrology, training for trainers’ on “Flash Floods Risk Management” was suggested to respond to the actual problems facing the Arab region. This training activity will be organized in 2011. A training manual will be prepared by a group of Arab and international experts.

Accordingly, UNESCO Cairo Office in joint Collaboration with UNESCO-HQ, ISESCO, ALECSO and G-WADI network organized the G-Wadi meeting on September 24 and was followed by an expert group meeting on Flash Flood Risk Management in Cairo Egypt during the period 25-27 September 2010. The meetings were held under the patronage of H.E. Dr. Mohamed Nasr El Din Allam, Minister of Water Resources and Irrigation and the meeting’s Agenda is shown in Appendix (A).

The opening Ceremony included speeches of Dr. Tarek Shawki, Director, UNESCO-Cairo Office, Dr. Hatem Mekhemer, Representative of ISESCO, Dr. Abualgasem El Badri, Representative of ALECSO and Director of the department of science and scientific research and Dr. Sameh Sakr on behalf of H. E. Dr. Mohamed Nasr El Din Allam, Minister of Water Resources and Irrigation.
The meeting aimed at discussing and launching the G-Wadi Arabia, presenting case studies on Flash flood risk management in the Arab region with special focus on previous experience, problems, gaps and success stories, defining the structure of a training manual on Flash Flood Risk Management (curricula) to be conducted in a TOT during 2011 with the involvement of all attended institutions and experts and finally assigning tasks, responsibilities and timetable for the training manual preparation.

The meetings are sponsored by UNESCO, ALECSO and ISESCO and attended by an intellectual group of experts from the Arab region and internationally. Among those are representatives of ISESCO, ALECSO and ACSAD; the G-Wadi members (Dr. Sooroh Soorehian, Mike Edmunds, Dr. Abdin Salih, Dr. Bisher Imam); the representatives of ICHARM-Japan (UNESCO Cat-2 institute-center of Excellence for risk management and coordinator of International Flood Initiative-IFI), ICIWaRM (UNESCO Cat-2 institute for IWRM-USGS), WMO, UNESCO HQ and UNESCO Cairo. The Arab region was represented by water experts and decision makers from Algeria, Bahrain, Egypt, Jordan, Libya, Saudi Arabia and Sultan of Oman. A complete list of participants with their respective country, address, affiliation and e-mail is included in Appendix (B).

Opening Ceremony

Dr. Tarek Shawki – Director, UNESCO-Cairo Office (Appendix C)

The speech of Dr. Shawki started with the opening statement that shows the importance of the topics of the meetings and the themes that deserve interest and attention since water is one of the vital issues that affect us all. He assured the full support and commitment to implement all relevant recommendations that would result from this important meeting.

Dr. Shawki addressed some of the water challenges and issues in the Arab region and the impact of the flash floods on the region. The magnitude of flood damage in the Arab region, combined with the uncertainty in current estimates of flood risk, suggest that water experts could benefit from improved scientific information and build capacities for flash flood risk management. He emphasized on the urgent need of more adequate understanding of the processes causing flash floods and more exchange of knowledge on flash flood risk management measures at institutional levels. Building the capacity of those working and dealing directly with flash flood will help to reduce flash flood risk in the region.

Dr. Shawki indicated that UNESCO’s International Hydrological Programme is actively engaged in fostering science and knowledge for addressing regional priorities and responding to water management challenges. Accordingly, UNESCO in joint collaboration with ISESCO and ALECSO organize the G-Wadi meeting and Expert group Meeting on “Flash Flood Risk Management”. The main purpose of these meetings is to discuss launching G-WADI Arabia and to discuss the executive procedures for the preparation of training manual on “Flash Flood Risk Management” to be conducted in a “training of trainers” workshop in 2011.

Dr. Shawki concluded his opening speech with his full support to the meetings’ recommendations. He thanked ALESCO and ISESCO for supporting these important meetings. He also extended his thanks to UNESCO colleagues at Headquarters and Cairo Office for their continuous efforts for the preparation and organization of these meetings. Finally, he extended
his thanks and gratitude to the Ministry of Water Resources and Irrigation of Egypt and H.E. Prof. Mohamed Nasr El Din Allam for their continuous support and cooperation.

**Dr. Hatem Mekhemer, Representative of the ISESCO (Appendix D)**

The opening speech of Dr. Hatem Mekhmer started by thanking the UNESCO-Cairo Office and ALECSO for taking the initiative to organize this important Meeting in joint collaboration with ISESCO. ISESCO in partnership with UNESCO and ALECSO has always remained active in supporting the Wadi Hydrology Program. He expressed his confidence in the vision, thought and new methodologies that will be discussed at the Meeting. All these would further expand the insight and enhance the capacities towards the integrated management of water resources, especially under Wadi Hydrology programme.

Dr. Mekhmer highlighted some facts about the water resources in the Islamic countries. The water scarcity and deterioration of water quality in most of the Islamic countries is not only hampering their socio-economic development process but also threatening their existence especially due to its relations with other critical factors like poverty, food and nutrition, and health. This water deficit in Islamic countries is expected to propagate more and more due to climate change, deterioration of the environmental conditions and the appearance of the phenomena of green house gases. Increase in water pollution is causing a real threat to human and it is a major cause of concern for the Islamic countries especially in the African region. It is necessary that we develop sustainable solutions through the promotion of integrated management of water resources and to take all precautionary measures to protect the biosphere in order to fulfill our moral obligations and responsibilities towards our future generations. The water provided by Almighty Allah is sufficient to meet our current and future demands provided that we manage it in a sustainable way.

Under ISESCO Water Programme a Strategy for Management of Water Resources was adopted by the second Islamic Ministerial Conference held in Tripoli and approved by the Islamic Summit Conference held in Malaysia, in Year 2003. Basic principles of this Strategy are that: fresh water is limited resource, essential for life continuity, therefore, needs to be protected, adequate supplies of good quality water must be maintained for all population, integrated water resources management is a collective responsibility of all, therefore, it is extremely important to increase water awareness to preserve it from pollution. An implementation mechanism of the Water Strategy as well as the General Framework of Islamic Agenda for Sustainable Development has been adopted by the Third Conference of Environment Ministers (ICEM-3), held at Rabat, Morocco Kingdom, in October, 2008 which is now under implementation.

For many countries, the development and efficient utilization of renewable resources of water in the wadi system is the only optimal solution for addressing water shortage problems. Population growth and the extended settlements in and around Wadis increase human and environmental problems especially those related to flash floods. The efficiency of water harvesting from Wadis depends on the understanding and knowledge regarding the qualitative and quantitative hydrology and water resource potentiality of the Wadi system. The natural scarcity of water in the arid and semi arid regions is further aggravated by man-made factors.

Dr. Mekhemer iterated the importance of the meeting and looking forward to the achievement of its objectives.
Dr. Abulgasem El Badri, Representative of ALECSO and Director of the department of science and scientific research (Appendix E)

Dr. Abulgasem El Badri, Director of Science and Scientific Research Department started his opening speech by the role of ALECSO in the issues related to the environment, desertification, drought and climate change. In collaboration with the international and regional organizations, ALECSO implemented several programs and activities to enhance the capacity of the Arab Region in these areas. ALECSO is maintaining its support to challenge these issues that become of great concern to the Arab Countries. These issues are vital to the socio-economic development and there is a great need to synergize the effort to assist in the sustainable development of the country.

Dr. El Badri stressed that despite the desertification problems in the Arab Region, some areas witnessed sever natural phenomenon which are not common historically. Among those disasters is the flash floods that had occurred in some Arab countries. Nevertheless, these countries did not have the capacity to combat its risk or to survive socially and economically.

Therefore, these meetings is part of the collaborative effort between ALECSO and the respectful partners to achieve one valuable goal. This goal is the capacity building of the Arab Region to acquire the basic knowledge and experience in drafting the appropriate policy and to set the efficient plans to forecast the flash floods before its occurrence. This will assist in mitigating the flash flood risk and reducing the damage cost.

Dr. El Badri concluded his speech by thanking the participants for their involvement in the meeting and he wishes that the outcomes of the meeting will be for the benefit of the Arab Region. He also stated that this meeting is an introductory meeting to further set of meetings that tackle the issues that are of great concern to the Arab Region and at the top of its priorities.

H.E. Dr. Mohamed Nasr El Din Allam, Minister of Water Resources and Irrigation (Appendix F)

Dr. Sameh Sakr, Director of the Water Resources Research Institute, delivered the opening speech on behalf of H. E the Minister. The main points of the speech are as follows:

He addressed the water shortage that increases gradually in Egypt. Away from the Nile renewable water resources are limited to the very little amount of rainfall that causes in some cases flash floods. These floods if properly managed, will serve the needs of the fragile communities located in the desert. To the best of their knowledge, the Bedouins explored all kind of techniques and technology that enabled them to survive during the past centuries. Since the adventure of the modern technology, scientists and engineers learned from the local inhabitants and adapted their techniques into the water harvesting projects. Starting from the rainfall prediction and the surface runoff estimation, Bedouins have the insight capabilities and knowledge to manage the rainfall.

Flash floods cause severe damages to the human lives and the infrastructures. Scientifically, Rainfall events in arid areas are hard to forecast, as they are irregular, highly variable in space and time and often highly localized. In addition, understanding the hydrology and hydraulics of the wadis are challenging due to insufficient insights in the response of wadis to rainfall events. Therefore, Early Warning Systems (EWS) can provide additional lead-time, which may reduce
damages. The joint cooperation between the Government of Egypt and the European Commission through the Life project has created such warning system in place. The developed partnership of this project has shown that scientists from different countries can work together to learn from each other and at the end to help the poor and the needy people.

The MWRI has taken some positive measures to manage the flood risks. Among those are: developing flood atlas for all Egypt, registering the Early Warning System as a tool for the daily management of the possible floods, developing an engineering code for the construction in flood hazardous zones, expand the water harvesting strategy to meet the demand of the communities located away from the Nile.

The speech was concluded by urging the participants to learn and work with each other through knowledge exchange to lessen the destructive impact of the flash floods and to maximize the utilization of the runoff before losing the water in such arid areas. Finally, he thanked UNESCO for their continuous support to face the water challenges in Egypt.

G-Wadi Meeting 24 September 2010

Historical background of G-WADI initiatives and needs for Flash Food Risk Management in the region

The opening Ceremony was followed by two introductory remarks. The first was given by Dr. Abdin Salih. He highlighted the historical background of the G-Wadi initiatives and the needs for flash flood risk management in the region. Dr. Abdin iterated the fact that each water drop counts in the Arab region and we should deal with flash flood as opportunity rather than risk. The flash flood could be utilized to maximize the recharge of the groundwater aquifers that exist in the wadi system.

IHP activities and recent developments

The second introductory remarks was given by Dr. Anil Mishra, UNESCO-HQ who talked about the International Hydrological Programme (IHP) which is the only intergovernmental programme of the UN system devoted to water research, water resources management, education and capacity building. The evolvement of the IHP started with the hydrology and water resources sustainable development in a changing environment (1990-1996), the hydrology and water resources sustainable development in a vulnerable environment (1996-2001), water interactions: systems at risk and social challenges (2002-2007) and is currently active with the water dependencies: systems under stress and social responses-IHP-VII (2008-2013). The current program is serving the achievement of the UN millennium development goals (MDG).

Dr. Mishra elaborated more on the IHP-VII which was designed to be relevant globally and locally. The program objectives cover two main goals which are: adaptation to impacts of global changes and cooperation of regional groupings. The program themes are (I) Adapting to the Impacts of Global Changes in River Basins and Aquifer Systems, (II) Strengthening Water Governance for Sustainability, (III) Ecohydrology for Ecosystem Sustainability, (IV) Water and Life Support Systems and (V) Water Education for Sustainable Development. These themes are
coordinated with the associated IHP Programme such as the IFI, ISI, PCCP, JIIHP, ISRAM, G-WADI, UWMP and WHYMAP.

Dr. Mishra presented the main objectives of the G-Wadi which are; (1) Improved understanding of hydrological systems and water management needs in arid and semi-arid areas, (2) Sharing of data and exchange of experience at regional and global scale and strengthening of global networks and (3) Capacity building of individuals and institutions and dissemination of understanding to users and the public. He also highlighted the activities of the G-Wadi Technical Secretariat in terms of capacity building such as the mandate of the International Center for Integrated Water Resources Management, the Asian G-WADI Web site http://asian-gwadi.westgis.ac.cn which is online since 2007. The website includes information about the Asian GWADI, some Pilot basins reports, Meeting materials and General publications from IHP, G-WADI, MAB, and other projects. One of the G-Wadi activities is the G-Wadi representative basins. This activity aims at stimulating and integrating regional activities, and using these for testing models, demonstration of new technologies as well as capacity building.

At the end, Dr. Mishra referred to some of the G-Wadi technical publications such as a book on hydrological modeling in arid and semi-arid areas and another book on groundwater modeling in arid and semi-arid areas. He also pointed out to the training facilities under the auspices of UNESCO such as the International Center for Integrated Water Resources Management (ICIWaRM), the regional center for training and water studies (RCTWS) and the Institute-center of excellence for risk management (ICHARM). Further elaboration on the G-Wadi was given by Prof. Soroosh Sorooshian in a following presentation.

**G-Wadi Expert Session**

The G-Wadi Sessions included three themes. First is the G-Wadi Programme, Cooperation and Regional activities. Second is the Linkages between G-Wadi and other programme, centers and initiatives. Third is the G-Wadi Strategy, objectives and future direction.

**Theme I G-Wadi Programme, Cooperation and Regional activities**

Under this theme, five topics were presented and discussed. These topics are:

- G-Wadi networking: opportunities and challenges
- G-Wadi and ICIWaRM Cooperation
- G-Wadi in Africa
- Proposed G-Wadi Network in Arab Region
- Linkages between GWA and other programs, centers and initiatives.

**Keynote: G-Wadi networking: opportunities and challenges**

The keynote speech was given by Dr. Sorooshian who talked about the G-Wadi networking and the opportunity and challenges. The G-Wadi is a global network www.g-wadi.org to share knowledge and experience on water and development information for the arid land. There is a close cooperation between the G-Wadi and the Center for Hydrometeorology and Remote Sensing (CHRS), University of California Irvine. Dr. Sorooshian talked about the mission of the CHRS which are: (1) Developing state-of-the-art systems to estimate rainfall from satellite observations at global scale and high spatial and temporal resolutions and (2) Utilizing Information Technology to provide world-wide access to real-time global precipitation products.
The G-Wadi sponsored and organized several training missions such as the training Workshop on Groundwater Modeling for Arid and Semi-Arid Area, the 2nd Asian GWADI meeting which was held in Lanzhou, China during the period June 11-17, 2007. The workshop was attended by 56 participants, including 9 invited experts, from twenty-two countries and 28 representatives of the Asian GWADI members from the nine Asian member countries, Workshop on Water – Science, Policy and Capacity Building, Dakar, Senegal 20-21 April 2010, Summer School on Land Surface Observing, Modeling and Data Assimilation and a Workshop on Arid and Semi Arid Development through Water Augmentation that will be held in China during the period 13-17 December 2010.

Dr. Soroosh addressed some technical outputs that the CHRS has produced in collaboration with some other institutions. He started with the definition of the flash flood as “A rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). However, the actual time threshold may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters”. He also addressed the flash flood warning guidance which estimates the average number of inches of rainfall for given durations required to produce flash flooding in the indicated county. These estimates are based on current soil moisture condition whereas, in urban areas, less rainfall is required to produce flash flooding. He also presented the GeoServer where you might have access to the real time precipitation data. He demonstrated the use of the system for the flood event of Pakistan in 2010.

Dr. Soroosh identified the Challenging Issues of Flash Flood management as follows:

- Flash flood problem is a local problem and needs to be defined in its local and regional context;
- Timely observation of rainfall events is crucial;
- More demand on Numerical Weather Prediction centers to produce more accurate Quantitative Precipitation Forecast (QPF) information;
- We must get serious about the use of GWADI products (Such as GWADI Geo-Server Rain estimate) and closer cooperation between modeling groups (i.e., ICHARM, CHRS) and data producers.
- More effective dissemination of information to the regional centers (GWADI websites)

Finally he warped up his presentation with two broader issues to be considered such as:

1. Attempt to get commitment from GWADI stakeholders to convince respective governments and policy makers to prioritize water resources of the arid and semi arid regions of their countries.
2. Lobbying with governments and policy makers to secure funding from governments and other bilateral funding sources for GWADI activities in the region.

**G-Wadi and ICIWaRM Cooperation**

Dr. William Logan, Deputy Director of the International Center for Integrated Water Resources Management (ICIWaRM) presented the profile of the ICIWaRM and the existing cooperation with G-Wadi. The ICIWaRM is an IHP Category-2 Center under the auspices of UNESCO and it is provided and funded by the Member States, committed to engage in support of UNESCO’s strategic programme objectives, render technical assistance through capacity-building and
ICIWaRM mission statement is “Advancement of the science and practice of integrated water resources management (IWRM) to address water security and other water-related challenges by regional and global action, through new knowledge, innovative technologies, collaborative interdisciplinary scientific research, networking, training and capacity development, within the framework of UNESCO’s International Hydrological Programme (IHP).” The ICIWaRM’s focus is in line with the USGS Objectives for International Water Resources, UNESCO IHP Program and US National IHP Committee.

The focus of the training center is three folds;

1. Practical science and technology development which can be readily transferred to improve integrated water resources management (IWRM) in developing nations and contribute towards meeting Millennium Development Goals.
2. Partner and support existing UNESCO-IHP programs which serve to implement IHP programmatic objectives related to IWRM.
3. Seek collaborations for joint applied research, capacity-building and training programs through existing UNESCO Centers and established programs, with particular emphasis on Latin America, the Caribbean, and Africa.

Dr. Logan gave some examples of ongoing or recently completed projects such as: the drought atlas for pilot regions of Latin America and this project was done in collaboration with CAZALAC, Chile. In this project, ICIWaRM created a free, non-proprietary program for regional frequency analysis. In terms of capacity building, ICIWaRM offered customized short courses on hydrologic and hydrogeologic modeling. The center participated in the design of the Middle East and North Africa Network of Centers of Excellence on Water. For the Senegal River basin, the center worked with local water management agencies on near-real time stream-flow forecasting systems, coupling satellite precipitation measurements and distributed hydrologic models. Through this project, the participatory approaches to planning, including social, economical and environmental aspects in addition to hydrology was promoted. Technology transfer was ensured to the local universities and local institutions.

To improve the cooperation between the ICIWaRM and the G-Wadi, Dr. Logan submitted a proposed Roles and Functions to maintain the GWADI Technical Secretariat at ICIWaRM. Among those pillars are:

A. OUTREACH AND COMMUNICATIONS

• Develop and implement an outreach and communication strategy of the Global G-WADI network,
• Setting up and maintaining web site,
• Act as liaison among regional and Global G-WADI networks,
• Seek info/news from network members to be published as news items,
• All network members would take initiative in feeding information to the website. We would anticipate that the UNESCO secretariat, or the regional GWADI groups, would take the lead in other publicity-related activities such as brochures and posters.

B. TRAINING AND CAPACITY-BUILDING
- Promote GWADI products such as satellite estimates of precipitation available at G-Wadi GeoServer (not direct financial support),
- Work together with IHP secretariat, G-Wadi advisors and Regional Groups of G-Wadi to organize capacity building workshops in member states (Financial support possible on an ad hoc basis; not intended to replace primary role of regional groups),
- Seek possibilities to provide necessary support if requested from regional networks’ basins, such as the establishment of a mechanism for exchange of experts (Financial support possible on an ad hoc basis and typically limited to the exchange of experts),
- Work with IHP secretariat to develop joint research initiatives on areas identified as common concerns for G-WADI networks.

C. PLANNING AND REPORTING

- Assist the UNESCO Secretariat in preparing an annual plan of action for the network, in close consultation with the Global and regional GWADI Network (the Secretariat would take the lead here),
- Assist the UNESCO Secretariat in preparing an annual report to be presented during the Global Advisory committee meeting (again, we feel the UNESCO Secretariat should lead the implementation of the approved global workplans; perhaps ICIWaRM might administratively coordinate implementation of workplans).

D. RECORD-KEEPING

- Maintain the records of the members of the network (lists of participants, emails and addresses. Reports from pilot basins could be posted to the website…etc.)
- Maintain records of the GWADI global and regional meetings (Meeting agendas, abstracts, and other related documents could be posted and archived; consistent with intellectual property law, presentations could be posted.)

G-Wadi in Africa

A presentation about Water Science and Policy Directions in Arid and Semi-Arid Regions of Africa was given by Prof. Mike Edmunds. Along with, Prof. Abdin Salih shared his experience in the region. Prof. Edmunds described the topics covered in the Dakar workshop that was held in April 2010. Most of the international experts were not able to make it to the workshop due to the ash cloud that delayed all the planned flights.

The presentation of Prof. Edmunds addressed the unique features of Arid and Semi-arid regions in Africa such as the unpredictability of rainfall, the climate contrasts of the 20th century and the prolonged drought, contrasts between arid and semi-arid regions (seasonally arid) and the data scarcity and reliability. The basic needs of the Dakar meeting were ensuring the knowledge base; protecting the ecosystems; water for cities; improving water governance and valuing water. Furthermore, water issues cannot be solved in isolation (climate, energy, people, food - and politics). At the Dakar meeting, three case studies from Chad, Sudan and Senegal were presented. The case studies emphasized the role of groundwater in the sustainable development and the risk of not managing these precious resources properly.

In order to have a scientific impact on the society, the scientific results should be communicated properly with the target audiences. As presented by Prof. Edmunds, the African water solution
and capacity building require a close focus on rural water solutions within sustainable resource limits; holistic development based on “water first”, improved rainwater harvesting initiatives including cisterns, aquifer recharge, managed information systems — valuing data, water efficiencies, groundwater controls, agricultural adaptation, putting the poor first: Policy failure is increased when the incentives, preferences and choices of the poor are ignored, capacity building and raising awareness at all levels and community involvement in programs.

Proposed G-Wadi network in Arab Region

The discussion on this topic was intended to conduct a brainstorming on the feasibility of launching the G-Wadi Arabia for the Arab region. Different thoughts were spelled out of the participating experts. In this regard, the following notes were taken:

(1) Dr. Abdin stated the possible formulation of the G-Wadi Arabia (GWA). He urged to propose a structure that ensures the sustainability of the network. The meeting of Khartoum could be the basis to launch the GWA. The GWA is important and there is a strong need for it and should be passed to the IHP. He proposed that UNESCO Cairo-Office take the lead to launch the GWA. The GWA will be a great potential for more cooperation between the Arab professionals.

(2) The activities of the other network should be supported such as the groundwater at risk and the wadi hydrology. The Ministry of water resources and irrigation should continue its support to these two programs.

(3) Two levels of commitment are required to ensure the success of the GWA. First at the institution and organization level. Second at the level of the involved members in the GWA.

(4) The Arab Region has a lot of potential to start the GWA.

(5) Dr. Abuelgassem El Badri proposed to hire a consultant to identify the available potential in the region to start the GWA.

(6) UNESCO Jordon-Office is willing to support the launching of the GWA.

(7) ALECSO is worried about the duplication of effort with other existing network especially; some representatives from the Arab countries are not present in the meeting.

(8) The idea of launching the GWA came from the national committee of the IHP.

(9) ACSAD has finished the Arab water strategy and the strategy includes both surface water and groundwater. Dr. Droubi suggested having a pilot project in the region but with very well defined objective.

(10) Oman has lots of cooperation with countries involved in flood management.

(11) A question was raised. Should the GWA be at the regional level or at the global level?

(12) Communication of real time data from the field is expensive and could not be part of the proposed GWA.

(13) We need to be more focus and define exactly what we are expecting from the GWA networking.

(14) The objective of the GWA is to address how to tackle the issues of the region. We need to define the issues of cooperation.

(15) Do we need to cooperate to face the water scarcity?

(16) The commitment of the professionals is key to the success of the proposed GWA.

(17) Initial priorities of the GWA members should be set in this meeting.

Linkages between GWA and other programs, centers and initiatives.
This topic was discussed among the representative of ACSAD, ISESCO, ALECSO, ICHARM, ICIWaRM, GWPN and RCTWS.

Dr. Abdullah Droubi – ACSAD asked about the leading agency of this proposed GWA. He also stated the importance of securing the financial support.

Dr. Hatem Mekhemer – ISESCO stated that ISESCO supports the G-Wadi and the GWPN and the capacity building in the Arab Region in general.

Dr. Abulgasem El Badri – ALECSO noted that strong links among the Arab countries exist and he is interested in the topic “environment and flood management”. He stated that the Arab countries are not efficient in utilizing their human resources and we need a lot of capacity building. He is thinking of a way to get all the Arab countries representatives to discuss the idea of having the GWA and then approve it. The objective of the meeting is to decide if there is a need for the GWA or not.

Dr. Kamoto – ICHARM could provide training modules for the G-Wadi Arabia. Droughts should be included as well as the flood management.

Dr. Will Logan – ICIWaRM stated that it is too early to formal launching the GWA. He raised two points. First, we need to identify who is willing to involve in the GWA. Second, why do we need another network?

Dr. Ahmed Khater – GWPN gave a presentation about the Network Activities and Achievements as well as a proposal to further improve the functionality of the GWPN and to secure its sustainability. Nothing mentioned in terms of linking the GWPN with the proposed GWA.

Dr. Maha Tawfik – RCTWS recommended to set the priorities for the GWA and offered that the RCTWS hosts the secretariat of the proposed GWA.

Dr. Waleed Al-Zubari is supporting the launching of the GWA and offering to host its activities.

Dr. Abdelaziz Zaki indicated UNESCO Cairo Office support towards the initiation of the G-Wadi Arabia responding to the real challenges and priorities of the Arab region. He stressed that the activities of G-Wadi Arabia can be a potential platform for cooperation among all partners and stakeholders in the field of capacity building and research.

Ms. Lama Al-Muslaha also emphasized on the support of UNESCO Amman for the initiation of the G-Wadi Arabia.

The concluding remarks regarding the strategy, objectives and future direction emphasized not creating something new but utilizing the available resources. Furthermore, it is needed to hire a consultant to draft a proposal for establishing the GWA. The consultant’s TOR will be developed by the G-Wadi experts. The G-Wadi meeting was adjourned and the expert group meeting on flash flood risk management started on the following day.
Flash Flood Risk Management Meeting (25-27 September 2010)

Flash flood risk management meeting: Day 1 (25 September 2010)

Several case studies from the Arab Region on the flash flood management were presented with a follow up discussion. The main objective of these case studies is to highlight the existing capacities in the region in relation to the flash flood management. The presentations addressed the previous experience, problems and success stories. Case studies from ACSAD, Egypt, Sudan, Oman, Libya, Yemen, Jordan and Algeria.

(A) ACSAD Experiences in Flood Risk Management and Rain water Harvesting

Dr. Abdullah Al Droubi highlighted the activities of ACSAD in the field of flood risk management and rain water harvesting. ACSAD is a specialized Arab organization working within the framework of the League of Arab States with the objective to develop the scientific agricultural research in the arid and semi-arid areas in order to increase the agricultural production in the Arab region and make use of the scientific progress and the modern agricultural techniques. The presentation covered ACSAD’s experience in the Arab region with two case studies from Lebanon and one case study from Jordan, Syria, Libya and Saudi Arabia.

I Flood risk management

In the field of flood risk management, ACSAD designed and implemented two projects as follows:

1. Flood risk management in El Qaa Watershed, Bekaa- Lebanon.

El-Qa’a city is subject to annual flash flood which results from heavy and intense rainfall events. Torrent coming from the nearby valleys causes severe damage to houses and properties in the city. The objective of this project was to reduce peak flow by 50% through the implementation of several water harvesting structures such as stone contour bunds, contour stone walls, gradoni terraces, check dams, hafirs and gabion diversion structures and Spillways. These structures were planned to function in several different ways:

- To assist in the rehabilitation of vegetative cover.
- to provide soil and water conservation;
- to decrease the velocity of runoff water; and
- To provide on-site storage of runoff water to serve in total the purpose of flood control.

The total storage capacity of these structures reaches up to 70,000 m$^3$. These structures performed well and the Hafir was filled with water after the flood of 18 May 2007.
2. Flood management in Northern Lebanon

It is a UNDP funded project in joint cooperation with the Ministry of Agriculture, Lebanon. The main objective of the project was to reduce the peak flow by 50% to protect the agriculture activities and the city located at the outlet of the watershed. ACSAD’s role constitutes the design and supervision of the water harvesting structure. Eight Hafir were established with a total storage capacity of 400,000 m$^3$. Mathematical models were used in the hydrologic analysis and in the design of the water harvesting structure.

II Rainwater harvesting

ACSAD contributed technically to the implementation of four water harvesting projects as follows:

1. Community based water harvesting and rangeland rehabilitation in Mafraq Area, Jordan

The total area of Jordan is about 89,206 km$^2$. Nearly 87% of this area receives around 100 mm of rain per year with a potential annual evaporation of about 2000 mm. Therefore most of Jordan's area is under arid environment. In joint cooperation with the GTZ, ACSAD introduced different techniques to improve the water use efficiency in order to maintain the land productivity and help to combat desertification.

2. Rainwater harvesting project in mountainous area, Syria

Al- Shiha village is located in a mountainous area approximately 45 km west of the city of Hama at elevation of 1030 meter above mean sea level and average precipitation of 1000 mm. despite the heavy rainfall in winter no water is available in summer. Also, groundwater is not available in the area. Therefore, a water harvesting hafir was constructed to supplement water during the dry period.

3. Water harvesting project using hill reservoir technique in Jabal Al Akhder, Libya

The study area is part of Jebal El-Akhdar Mountain and encompasses 6930 km$^2$. The overall long-term goal of the project is to provide additional sources of water supplies in Jebal El-Akhdar area through effective implementation of water harvesting techniques in order to increase and stabilize agricultural production. ACSAD developed criteria for selection potential sites for rain water harvesting structures. These criteria include soil suitability, slope suitability, land use, cultivable area, accessibility of sites, and runoff potential. By combining all these layers using GIS someone can produce a suitability map for hill reservoir locations. This project was funded by the Islamic bank for development in Year 2010.

4. Integrated Management of Water Resources in the Wadi System, Saudi Arabia
This project was implemented on wadi El Lith with the main objective to apply different appropriate methodologies to ensure integrated and sustainable management of the water resources in the wadi system as a pilot study for arid zones hydrology. The project was implemented during the period 2007-2009 in collaboration with the Saudi Arabia Geological Survey. The major outcome of the project was the identification of the best location for the water harvesting.

### III Contents of ACSAD – GTZ Manual on Flood management (Under preparation)

ACSAD is in process of developing two manuals on flood management as follows:

1. **Flood control (water harvesting)**
   - Methods
     - Water storage
       - Small earth dams
       - Small weirs
       - Sand dams (sand pockets)
       - Off-stream storage
       - On-stream storage
       - Below ground storage

2. **Flood Management Measures**
   - Structural measures
     - Reservoirs and Detention
     - Diversion
     - Channel improvement (e.g. Embankment, excavation)
   - Non-structural measures
     - Flood Forecasting Network
     - Dissemination of flood Information
     - Hazard Map
   - Using hydrological modeling for flood management

**B) Flash Flood Risk Management: Egypt Story**

Dr. Sameh Sakr, Director of the Water Resources Research Institute (WRRI) presented the institute profile and the available resources in the institute. WRRI is a Scientific Organization Committed to Excellence in Research and Development in all aspects related to the sustainable water resources development in Egypt and Sinai in particular. Enhance the collaborative applied research to achieve the sustainable development in the water scarce areas (Eastern Desert and Sinai). The main goals of the institute are to explore and develop the available water resources to improve the socio-economic conditions and optimize the utilization of the available water resources in an environmentally safe manner. The institute plays a major role in the national water policy whereas WRRI is responsible of developing the water harvesting strategy in Egypt, develop flood Atlas for the vulnerable governorates (Sinai, Red Sea and Upper Egypt), design flood protection and water harvesting structures and manage the flood early warning system.
Egypt acquires the capacity to manage the flash floods through the available human resources at WRRI, the rainfall and runoff monitoring network and the early warning system operated through the weather research forecast model. Through the available wealth of information, Egypt developed the flood atlas for Sinai Peninsula and in process of replicating the idea for all the vulnerable governorates in Egypt. The atlas includes information about the location of the wadi, digital elevation model (DEM), land slope, available rainfall and runoff data, geomorphologic characteristics of the wadi, volume of runoff for the 50 and 100 year floods, flood risk, flood intensity and the existing water harvesting structures.

Through the past 30 years, WRRI staff gained a lot of experience in the hydrologic data analysis, identify and design the optimal water harvesting and flood protection techniques, using the Weather Research Forecast (WRF) for the flood early warning. Despite the available resources, people never think of flash floods in Egypt until it occurs, decision makers have no tools to assist them in the planning against flash floods, law enforcement is absent and random settlement of the immigrants is common inside the wadis.

The management of the flash floods in Egypt is still facing some constraints. Among those are (1) data is discontinuous and never enough, (2) lack of awareness against the flood risk, (3) Bedouins and the local people are not entirely involved in the planning of the flash flood mitigation, (4) networking with the neighboring countries does not exist.

WRRI experienced a successful story in managing the flood of January 2010. The forecast of the WRF was sent to the ministry officials in the vulnerable governorates, the warning was sent via e-mail, the storm started on Saturday and continued on Sunday, Phone calls were made to our field representatives and some MWRI official, nobody believed it including our self, our field representatives started to observe the surface runoff and we start communicating the data, the officials in South Sinai took the preventive actions towards closing the roads and set up the evacuation plan, we ran the WRF for higher resolution to pick up the progress of the storm.

The January flood had some negative impacts on the roads and the infrastructures that are crossing the wadis. On the other hand, some positive impacts were encountered. The flood protection structures performed very well and the destruction of the roads was reduced significantly, more than 4 million m$^3$ were harvested through the underground storage tanks, the retention dams and the artificial lakes. Furthermore, great impact was observed on the groundwater levels and salinity.

Dr. Sakr wrapped up his presentation with the lessons learned from the January 2010 flood. Several positive actions were taken in response to the flood damage. Among those are the development of the Flood Atlas of Egypt, improvement in the believe of modeling and the new technology (WRF), building trust between the scientists and the decision makers, fund was made available to enhance the performance of the data collection and capacity building, investors have asked to conduct a flood risk assessment, flood Code is being developed to regulate the development in the flood risk zones, improvement in the information dissemination about the flood risk and finally flash flood harvesting is included in the MWRI policy.

(C) Flash Floods Risk Management: Sudan Experience

Dr. Babkhir Barsi and Dr. Abdin Saleh presented the Sudan experience in “Flash Floods Risk Management”, the associated problems, gaps and success stories, some case studies from Sudan and recommendations for future activities and regional cooperation on Flash Floods Risk Management. Flash floods are considered as one of the main water related hazards. Over the
last fifty years, Sudan had encountered a number of flash floods on the seasonal Wadis, claiming many human lives and causing damages at massive scales to the, rural, urban and agricultural areas, as well as to the livestock. Though these floods last for a few hours, yet their arrival time and places of occurrence are completely unpredictable. They come with fast speeds and roaring sounds like thunder, carrying debris and trees and rolling stones and large rocks. They have large destructive powers and wash away almost anything in the Wadi from human beings and livestock to lorries and heavy trucks. In many places in Sudan, only their roaring sound is the available warning system leaving no time for evacuation efforts. As a result severe environmental and socio-economic problems occurred. They presented the quantitative impact of the flash floods on the human lives and livestock.

There are five distinct geographical regions in Sudan. These geographical regions are the Western Sudan, Northern Sudan, Eastern Sudan, Central Clay Plains and the Nilotic Plain. The nature of the flash floods is different from one region to another. They described the Hydrologic Network which includes the meteorological data and the rainfall and runoff network. The main source of metrological data is the Sudan Metrological Authority (SMA). Until the late seventies, the department used to have a meteorological network of more than 300 climatic stations well distributed all over the Sudan. Unfortunately, the network had suffered great deterioration over the past few decades and the number of working stations in the whole country is now not more than 30 stations. Most of these stations have records of evaporation, measured with Piche Tubes, for more than 80 years. Class A pans are also used. These key stations measure other meteorological factors as well (i.e. humidity, temperature and wind speed). For the rainfall network, there were more than 1500 ordinary rain gauges in the Sudan. However, at present there are only about 500 rain gauges in operation. The main problem is that these rain gauges are not well distributed over the country. There are 40 first class meteorological stations which are equipped with autographic rainfall gauges. Each station represents a number of Wadi systems.

For the wadi flow network, the stream flow gauging in some of the Sudanese Wadis (like El Gash) had started as early as 1907, but for most of the important Wadis gauging was started in 1956. Until 1980, there were more than 60 flow gauging sites in the different parts of the country, which were reduced significantly during the 1990s. The gauged streams are quite few and the period of gauging is still too short to give reliable and representative data. Fortunately, this year, the Dams Implementation Unit equipped about 40 Wadis with autographic rainfall gauges and automatic water levels recorders.

For the flash flood forecasting techniques, Sudan does not have a flash flood early warning system. However, there is a need for speedy collection and translation of hydrological data to provide for fast operational forecasts. The key feature of flash flood forecasting is to identify quickly whether the forecasted flood is above a certain threshold rather than predicting the peak flow discharge and its time of occurrence. Hence, flash flood forecasting does not require a complex model (Lin, 1999).

Dr. Barsi demonstrated the different mathematical models that could be to estimate the surface runoff for a given rainfall storm. Furthermore, he demonstrated Sudan experience on Flash Floods Management. It is all about the engineering works that are used to control floods and reduce their damages.
The presentation was given by Mr. Rashid bin Yhaya Al Abri who is working with the Ministry of Regional Municipalities and Water Resources, Sultanate of Oman. He started his presentation with the geography and demography of the country. The rainfall pattern is classified into four principle mechanisms which are (1) convective rainstorms, which develop at anytime of the year, but mostly during the summer months, (2) cold Frontal Troughs, which originates over and the Atlantic ocean or Mediterranean sea, which are common during winter and early spring, (3) on-shore Monsoon currents, which occur from June to September that bring complex regional circulation which result the Khareef in the southern part of Oman and (4) tropical cyclones, moving in from the Indian Ocean and Arabian sea. The water resources are monitored by the Ministry of Regional Municipalities and Water resources through 4683 different stations. Out of these stations, 15 are working on satellite and 30 GSM stations. The collected data is stored in a national database with records for more than 100 years in some rainfall stations.

Consequently, he talked about the floods in Oman which often occur with little warning, causing property damage, community disruption, and at times, loss of life. In order to reduce these disruptions from floods, the Supreme committee for town planning has established guidelines for development in the flood prone risk areas in Oman. The ministry of Regional municipalities and water resources has the task of investigating and analyzing the hydrologic conditions of flood events and producing maps showing flood risk zones under its nationwide flood study program, which was initially proposed in 1987.

Mr. Rashis talked about the problems associated with the management of the flash floods in Oman. Some examples are the drought periods, lack of coordination's between different sectors, greed and courtesies. The historical floods in Muscat show that the areas have been flooded several times; for example: in 1974, 1981, 1987, 1990, 1997, 2003, and 2007 (Guno) flood 2010 (phet). The highest recorded flood values in Muscat gauge stations was in AL Khawd station which is about 2329 m3/s In 1950, the second highest recorded is about 1150 m3/s in 14th November 1997 at Al Bajariyah station.

He presented the flood event of June 2007 and what was happened since the early watching of the storm till the end of the surface runoff. GONU was first observed as a tropical depression in the Indian Ocean on 27th May by Satellites. It reached category 5 on June 6th, but then downgraded to category 1 by June 8th 2007 while crossing Iran lands. All concerned parties were informed and a call for emergency meeting was issued and the evacuation plans were implemented. Despite the evacuation plan, 49 were reported dead due to the improper behavior of the people during the flood. After this catastrophic flood, several actions were taken such as the creation of a National Multi hazards center, compile all available data and resources, develop a flood early warning system, produce flood risk maps, improve the coordination among the stakeholders, remove the illegal structures inside the wadis and build a series of dams for flood protection and water harvesting.

Mr. Najy Shakshem who is working with the General Water Authority in Libya presented some general information about the geography and demography of Libya. In terms of water resources, the climatic conditions are influenced by the Mediterranean Sea to the north and the Sahara desert to the south. The annual rainfall is extremely low, with about 93 percent of the land surface receiving less than 100 mm per year. The Government has constructed a network of
dams in wadis to serve as water reservoirs and for flood protection and erosion control. Currently there are 18 dams in operation and three are under construction.

Mr. Najy presented a case study for flood protection project in Sirt city. The city is located near the sea about 500 km east of Tripoli and the city is threatened by the flood of Wadi Talal. The main objective of the flood protection is to protect the city and the human lives and water harvesting by means of check dam for infiltration to recharge the groundwater aquifer.

The hydrologic characteristic of the catchment reveal that about 90% of the catchment area (the south part) is defined as a desert climate while the northern part (about 10%) can be classified as an arid or semi-arid climate. The mean yearly rainfall is 201 mm. The extreme precipitations are really irregular on the catchment area. The heavy rainfalls are mostly located on the northern boundary of the catchment area, near the Mediterranean coast. The extension is limited in the South between 80 and 100 km from the coast.

For the flood risk hazardous, he presented the defined of the flood intensity level, the hazard level and the objective of flood protection matrix. The definition of the objectives of protection depends on the importance given to different types of objects.

At the end of his presentation, Mr. Najy demonstrated the different type of flood protection structures that were used to protect Sirt City.

(F) Flash Flood Risk Management in Yemen: Previous experiences, problems, gaps and success stories. Case study: Sana’a City

Dr. Abdulla Noaman who is affiliated with the Faculty of Engineering, Sana’a University presented the case study of Yemen. He started the presentation with two videos for the recent flood that occurred in 2008. The formal presentation started with some background information about the geography and demography of Yemen. He mentioned that there are three sources of natural hazards in Yemen which are the Land degradation, floods and firewood. Floods occur during monsoon season leading to loss of productive agricultural lands along the wadis, increasing sedimentation and significant widening of downstream wadi bed.

Dr. Noaman presented the flash flood that occurred in October 2008. During this flood event, heavy rains had continued for three days in south eastern and south western Yemen resulted in flash floods throughout Hadramaut and Maharah governorates. The floods in these two governorates resulted in the death of more than 100 people and up to 20,000 are displaced. Roads, communication facilities, power and water distribution networks were disrupted as well. The hydrologic analysis of the collected data revealed that quick flow is observed in the main wadis immediately after the rainstorm and is characterized by flash flood due to the high topography and slopes and cause damages. Inspection of some of the recorded water level hydrographs shows that time to peak for floods resulting from rain storms range from approximately 15 to 60 minutes (Instantaneous flood hydrographs).

Dr. Noaman continued to present the rainfall monitoring network. He stated that most of rainfall stations were installed during the late 1970s or 1980s and around 280 rainfall stations cover the country, (40% automatic recorder) and 45% abounded. Several stations have been abounded already and many of the record have major gabs in the period of observation. On the other hand, most of the streams gauging stations are equipped with water level recorders.
He addressed some of the gaps and challenges that they are facing with respect to flash flood management. He started with the information gaps where data is discontinuous and sometimes total absence of data (e.g. wadi discharge, rainfall) for some wadis. Also, there is a problem with data exchanges and data dissemination. Secondly, he addressed the social gaps which mainly related to the lack of awareness against the flood risk. Finally, he addressed the technical gaps which include the design criteria and guideline for the monitoring network, types of the monitoring stations, operation and maintenance of the monitoring stations and solid waste and sediment problems.

He presented another case study in Sana’a city which was severely affected by the flash floods. The urban development of Sana’a has led to an increase in flood hazard for two reasons: (1) modifications to existing land features and (2) presence of increased population and buildings in flood prone areas. In respect to protecting the municipality from flood risks, the municipality has been engaged in implementing one of the mega projects within the country which is El-Saylah Drainage project. He also presented the different techniques that are used in Yemen to manage the flash floods. Furthermore, he presented the flood plain for wadi Saylah for different return period.

At the end of his presentation, he set some recommendations to improve the flash flood management. Among those are:

• Carry out intensive monitoring program
• Improve the data exchanges and information disseminations
• Develop the flash flood management guideline and training curricula
• Develop flash flood early warning system
• Law enforcement
• Enhancement of Stockholder’s participation in management and design
• Awareness programs
• There is a need to develop specific and targeted education and training programs.

(G) Flash Flood Risk Management: Jordon case study

Dr. Khaldoon Al-Qudah, Director of UNESCO Chair for Desert Studies, Yarmouk University presented the case study of Jordon. He viewed floods as hazard and a water resource. Floods in arid and semiarid regions are considered the only hydrologic process that generates large volumes of water for both surface storage and groundwater recharge. Maximum dam’s storage is only attained during floods. Before one decade or more, there was a problem to convince peoples and decision makers that flooding is a problem. Recently and as urbanization expands toward more arid areas, people start think seriously about flood hazards. In Arid regions the most frequent cause of flooding is heavy rain. Intense heavy thunderstorms with heavy rainfall are main cause flash flooding. Every year there is a large magnitude flood in Jordan, especially in the southern part. Flash floods are common feature of arid regions, but poorly understood; because of lack of accurate environmental data and this put limits on the development of arid regions.

He demonstrated the history of floods in Jordon and he specified that the floods that cause loss in life and damage in property are occurred in southern parts of Jordan which near Aqaba City. In 1940s terrific rainstorm washed away half of Aqaba city and on January 7, 1944, in 1945, and a major flood on May 12, 1950 struck Aqaba city. In March 1966, a catastrophic flood struck the town of Ma’an in southern Jordan. It is reported that approximately 200 people were killed, and
over 250 were wounded. About half of the buildings of the town were destroyed, and over three thousand people were rendered homeless (Falastine daily newspaper, 1966).

In 1963 Petra was struck with a destructive flood, 27 French tourists were killed and Wadi el Yutim dam was destroyed during that flood (Abu Hussain, 1994). Recently in February 2006, Aqaba witnessed a big flood, 2 people were killed. Property damage to airport and wastewater treatment plant is estimated with 9 million JD (Alrai: daily newspaper. Feb 7th 2006). Petra was flooded again in 2009 and tourists were surrender by flooding.

Concerning the flood risk management in Jordan, Dr. Khaldoon highlighted the demography of Jordan. Most population is concentrated in the northwestern part of the country where more rainfall fall exists. More than 90% of population is found in less than 10% of the country area. Major cities are found in the highlands (in upper portion of the drainage systems that flow to the Jordan Rift Valley). In the northwestern part where most population situated, Jordan has good control on floods; even it receives the highest amount of rainfall. Most major wadis in the populated areas have flood control dams which protect the downstream low-lying areas in the Jordan valley. The risk of flooding in the southern part of Jordan is high due to the following reasons: (1) information on rainfall amounts, intensity, distribution and stream flow is very rare, (2) the area is steep, bare rocky terrain, (3) the area is exposed to intense storms (thunderstorms) influenced by the effect of the Red Sea Trough and (4) there are very few flood control structures made on the major wadis in the area.

For the existing flood control structures, Dr. Khaldoon presented some engineering mistakes either in the design or during the implementation. At the end, he presented the problems associated with the flood risk management in Jordan. These problems encounter the lack of reliable hydroclimatic data regarding rainfall intensity, distribution, frequency, lack of forecasting tools and models and lack of information about stream flow. To overcome the problems of lack of information about rainfall and runoff in arid and semi arid regions, a paleohydrology technique has been developed to build a flood proxy for un-gauged catchments. He concluded his presentation with the definition and application of the Paleoflood hydrology. It is defined as integration of geological principles, methods and data with those of hydrology, hydraulics, and even climatology for the determinations of the magnitude and / or frequency of large floods that have occurred in absence of direct documentation, observation, or instrumentation (House, 1999).

(H) Flash Floods in Algeria: Impact and Management

The case studies from Algeria were presented by Prof. Benazzouz Tahar who is affiliated with Mentouri University, Constantine Algeria. He also talked about the consequences, damage and disasters of the floods. The risk management strategy in Algeria is regulated by a law that covers different plans such as insurance, re-housing.

The first case study of bab el oued in Algiers occurred on November 10th, 2001. The measured maximum water level (leaves of flood) is 2.45 m, which give a flow max 730 m3/s and a total contribution of 2.600.000 m3. The empirical estimate of the carried sediments produces a volume of 800.000 m3. The statistical analysis of the rainfall data for the period of 1951 to 2000 makes it possible to locate in frequency the rainy event which has occurred November 9th and 10th 2001 around one period of 90 years return period. The consequences of the catastrophic flood of bab el oued resulted in 712 died, 115 missing, 311 wounded and more than 1454 families without shelter, destruction and buried of 389 vehicles, extensive damage caused with
the infrastructures: (deteriorations of the roads, formation of craters of more than 10 meters in diameter), strongly damaged networks of cleansing, silting of streets, degradation of the buildings, school, and houses, landslides, erosion and destabilization on the foundations and elements of the structures, economic costs (evaluated to 544 million Algerian dinars of damage or 4 billion US $).

The second case study is the flash flood in Ghardaia which was occurred on October 1st 2008. The analysis of the event revealed that on Sept 28th 2008, the rainfall was 11 mm, Sept. 29th 2008, rainfall was 40.5 mm, on 30 Sept. a rain storm between 3:00 and 4:00 h in the morning of an estimated intensity at 150mm/h. on October 1st, 2008 a strong rainfall between 3:00 and 4:00 in the morning with an intensity of 28.2mm/h. In the morning of October 1st, and following the 28.2mm, a devastator flash flood appears on the wadi M’zab with general and catastrophic overflow.

The third case study is the floods in the Sahara desert at the area of DOUCEN in Zibans, September 2009. This flood caused destruction of a hilly dam in Zibans. Consequences of the floods encountered the losses of the date’s production. The last case study is in Constantine where he presented the historical records of the floods and the consequence of the disaster.

At the end of his presentation he recommended three pillars to reduce the risk of flood, it is necessary to act in three directions:

1. To reduce floods by acting on the phenomenon itself;
2. To reduce the vulnerability of the people and the goods to the events (to imagine the development in priority apart from the floodplains, controls and limit urbanization);
3. To better know to live with the risk by developing the knowledge and the comprehension of the floods (to familiarize itself with the cartography of the floodplains, reference marks of the risings).

Existing capacities and major challenges

As shown in the country presentations, the capacity for the flash flood management does exist in the Arab region such as:

(1) Hydrologic data analysis;
(2) Using the hydrologic models in the design of the water harvesting structure;
(3) Development of the flood atlas and flood risk maps;
(4) Manuals for flood management and flood protection;
(5) Applying the early warning systems and the flood forecast using the mathematical models;
(6) Simple hydrologic methods could be sufficient for the flood management;
(7) The positive response of the officials to the warning signals;

However; major challenges are encountered in the region such as:

(1) Lack of continuous data for both flow and rainfall;
(2) No real time data transmission;
(3) Soil erosion problems in the mountainous areas;
(4) Maximizing the use of the flood rather than managing the flood risk;
(5) Regular maintenance of the water harvesting and flood protection structures;
(6) Site selection to avoid sedimentation and evaporation is always a challenge;
(7) The negative response of the officials to the warning signals;
(8) Flood management in the un-gauged streams;
(9) Absence of the flash flood early warning system;
(10) Absence of disaster risk management plan;
(11) No great consideration to the multi users (stakeholders; participation);
(12) Model availability to describe the hydrologic conditions of the Arab region;
(13) Social gaps in terms of the awareness to the low frequency catastrophic events;
(14) Communication technology is inaccessible and very expensive to upgrade;
(15) Post disaster assessment is demanding task. Looking to have technology to facilitate speedy assessment and post event analysis;
(16) Lack of integrated approach for the flash flood management, not only warning system but full cycle and continuum;
(17) Lack of methodology of risk assessment;
(18) Lack of design criteria for the rainfall network;
(19) Conflict between technical and management mandates.
(20) No insurance policy against flood disaster;
(21) Lack of access of data collected by previous studies through international partners;
(22) Dispute and conflicts among the institutions who are responsible of the flood management;
(23) Lack of legal framework for the preventive construction;
(24) Looking at the flash flood as a source and blessing rather than a risk;
(25) There is a knowledge gap starting from the data and information, data analysis; human skills; attitude (don't give up as a professional) and value of data.
(26) Training of trainers is needed for all aspects related to the flash flood aspects.

Flash flood risk management meeting: Day 2 (26 September 2010)

The third session of the meeting was devoted to the flash flood forecast and risk management. The session was chaired by Prof. Waleed Al Zubari and Prof. Soroosh Sorooshian and the Rapporteur is Dr. Bishr Imam.

The session started with a presentation on the rainfall system of the Arab Region and risk of flash flood over Red Sea and Sinai. The presentation was given by Dr. M. Dawod, Director of Bounder Layer Research-Egyptian Meteorological Authority (EMA). The presentation covered several topics started from the climate of the Arab Region, Relation between the amount of rainfall and the surface runoff of the flash flood, identifying the flood intensity from the historical data, using the satellite image and vertical profiles of both wind speed and direction to study the two case of flash flood over Red Sea and finally forecast the flash flood over Red Sea (Arab region).

The climate of the Arab region is affected by two systems. The first rainfall system is the system affected by the Mediterranean Sea. During the winter time and the transitional seasons, the region is affected by the traveling depressions over Mediterranean Sea. When these depressions developed to cold/joined to cold upper lows, they are associated with large amounts of high and medium clouds, as well as, with thunderstorm storms, which can cause very heavy showers of rain and hail. The general rainfall over the Arab countries located in the vicinity of the Mediterranean Sea have small amount of rainfall but the number of rainy days is
The rainfall over the Arab countries in the vicinity of the Red Sea have very large amount of rainfall but the number of rainy days is small. Therefore, these countries in the region of the Red Sea are vulnerable to the flash flood risk. The general climate of the Arab region in summer (June - September) is hot, dry and rainless except Sudan which experience heavy rainfall during the period July to September and are at risk of the Nile flood.

The second rainfall system is the system affected by the Red Sea and this system normally causes flash floods over the region. Some physical facts about the region include the strong wind speed at south direction on height of 2-3 km from Saudi Arabia in the South and the Indian Ocean. This wind is the cause of providing the water vapor from the Indian Ocean to the south of Egypt and causes big cloud over the Red Sea at south of Egypt. Topography of Red Sea plays a major role in the flash flood over Sinai.

Dr. Dawod presented the historical flood event in Egypt since 1968 and he presented an equation that could be used to correlate the flood intensity and the rainfall intensity. He also pointed out that the number of the flood events is increasing over the past decade. The EMA has the capabilities to forecast the rainfall distribution using the satellite images and a lot of research is going on.

An overview of flash flood warning systems was presented by Prof. Bisher Imam. He started with the definition of hazards (Potentially damaging physical event, phenomenon or human activity. May cause loss of life or injury, property damage, disruption and/or environmental degradation), vulnerability (Capacity (or lack of) to anticipate, cope with, resist and recover from the impact of natural hazard) and risk (Chance of loss of life or Injury, property damage, disruption and/or environmental degradation). He defined next the early warning as “The provision of timely and effective information, through identified institutions, that allows individuals exposed to hazard to avoid or reduce risk and prepare for effective response, NOAA-Abura Valley Early Warning System Document”. Along with, he defined the flash flood as “A rapid and extreme flow of high water into a normally dry area, or rapid water level rise in a stream or creek above a predetermined flood level beginning within 6 hours of the causative event, NOAA-FFEWS Reference Guide”.

He presented an integrated system for the flood early warning system. The system includes risk information, Hazard Data & Forecasts and Communication & Dissemination. He also presented the methodology for hazards characterization, the use of the flash flood guidance to predict the rainfall-runoff, flash flood monitoring and prediction.

He presented the Central America Flash Flood Guidance System (CAFFG) which is composed of operational meteorological and hydrological services in seven Central American countries to issue effective flash flood warnings for small river basins. It is fully automated real-time system. He also presented the early warning system of Egypt FlaFloM which is based on using the GIS tools, rainfall Satellite Precipitation estimate, rainfall-runoff model; output of WRF, Gauges, hydrodynamic model and real-time flash flood management tool.

At the end of his presentation he raised the question ‘Are satellite data reliable’ and he presented the dual residual plots. It is a tool that is used to compare the predicted against the measured rainfall and to check the reliability of the satellite data.

In response to the participants’ questions, Dr. Bisher supported and urged the use of the available communication tools (Radio, Mosques Minarets…etc) to send the warning alarm to the residents and the decision makers. He also emphasized the strong need for the skills to analyze
the hydrologic data. Traditional insights about flash floods should be integrated in the Flash Flood Management Strategy.

Dr. Waleed Al Zubari presented the methodology that was adapted in the development of the IWRM training manual for the ESCWA region. He presented the different training modules that fit the needs of the professionals and the decision makers working in the field of the IWRM.

Apart from the individual experience in developing training manuals, Dr. Kamoto and Dr. W. Logan presented the available training modules and software that are available at the ICHARM and the ICIWaRM institutions.

The ICHARM has developed a very comprehensive training program for the flash flood risk management. The training curriculum includes computer programming, practice on hydraulics, practice on local disaster management plan, practice on advanced hydrology, practice on flood hazard modeling and flood forecasting, practice on sustainable reservoir development and management and practice on control measures for landslide and debris flow.

The training materials are tailored to fit the target groups and the duration of the course. ICHARM offers short-term training courses such as (1) Flood Hazard Mapping (FHM) Training Course, (2) River and Dam Engineering Course III and (3) Local Emergency Management Plan with Flood Hazard Maps (started in 2009). Also they offer one year Master’s Course “Water related disaster management course” and Doctor Course for three years (started in Oct. 2010) on “Disaster Management”.

Dr. Kamoto demonstrated the outline and the contents of one of the training modules. The overall presentation showed the existence of good training manuals that could be adapted to the Arab region after some slight modifications to fit the hydrologic characteristics of the region.

The ICIWaRM demonstrated some of the software and techniques that they are used in the Flood Risk Management. One of these tools is the HEC model which is freely available, downloadable tools that support the Planning Analysis Process, including flood risk management. The HEC is part of the corps’ Institute for Water Resources, home of the ICIWaRM secretariat.

Dr. Logan demonstrated the capabilities of some of the Hydrologic Modeling System. Among those is the HEC-HMS which computes stream flow throughout a river basin given precipitation and watershed characteristics. Another model is the River Analysis model HEC-RAS which is a one-dimensional hydraulics program that computes river velocities, stages, profiles, and inundated areas given stream flow and geometry. It accounts to steady and unsteady flow. For the flood risk management analyses and project benefit analysis including loss-of-life, the HEC-FDA and HEC-FIA are available evaluate flood risk management measures (structural and non-structural) using risk and uncertainty and including systems approach and GIS capability.

The flood damage reduction analysis HEC-FDA is used to plan evaluation and plan formulation tool – separate from hydraulic and economic modeling. It helps answer the question "Which proposed flood damage reduction plan is the best from an economic standpoint"? The Flood Risk Management HEC-FRM tool is under development which is the next generation of HEC-FDA. It does risk analyses for system-wide studies and will be used to plan, design and evaluate infrastructure and perform levee certification and assessment. It includes systems approach, event-based sampling, scenario analysis, and structure-by-structure, cost, non-structural, loss-of-life, and agricultural damage analysis.
In his conclusion, Dr. Logan emphasized that modern suite of hydrologic engineering, planning analysis, and emerging ecosystem functions models were developed and supported and used nationwide. Some of the tools require a lot of information; others not so much. The HEC software continues to be public domain, freely downloadable, with manuals, at [www.hec.usace.army.mil](http://www.hec.usace.army.mil).

The flash flood forecast and risk management session was concluded by an open discussion from the participants. The discussion covered the following two themes: (1) gaps in data, systems and human resources, (2) training needs and priorities and. The major findings of the discussion are as follows;

### Data/Information gaps

- Lack of data, or discontinuous data, on rainfall (amount, intensity, spatial distribution, frequency) and stream flow (un-gauged catchments)
- Near real-time speedy collection and translation of hydrological data for fast operational forecast - Time from rainfall to peak flood is only 15-60 minutes in many cases.
- International data exchanges
- Special data collection techniques for wadis to avoid data loss due to stream gauges washing away
- Paleoflood hydrology studies to extend sparse hydrologic records into the past
- Preparation of flood maps (hazard maps)

### Technical gaps

- Operations and maintenance/recalibration of structures, sedimentation control
- Development of low/medium-tech early flash flood warning systems?
- Preparation of regional Damage Risk Map action plans
- Develop flash flood management guidelines
- Greater consideration of multiuse structures – combining flood control with groundwater recharge
- Development of design criteria (for structures?)
- Design criteria for the rainfall-runoff monitoring network
- Existing models that simulate the hydrologic conditions of the arid region
- Flash flood forecasting techniques? Simple technologies that work (basins…)
- Representative catchments at field scale
- There is a need for an integrated system to describe and mange the flash floods
- There is need for a regional model that simulates the flash floods in the region.

### Social/Institutional gaps

- Long drought periods produce complacency and lack of awareness of risk / Need for awareness programs
- Lack of awareness/understanding of relation between poor soil/land/forest management and rapid runoff.
• Enforcement of laws and regulations “greed and courtesies” allows people to extend their properties into high-risk areas - Unwillingness to restrict areas for development
• Not enough stakeholder participation in management and design
• Lack of coordination among ministries/sectors

Training needs

• Training is for professionals first to convey the message to the technicians down and the decision makers up.
• Capacity development? Who is our target audience, Unless we decide who is our target audience. Prioritize target audience,
• Capacity development include institutions, add as many as we can on the list.
• Capacity development is in itself a GAP. Recognition of lack of trained staff is an important step towards capacity development
• Along with updating systems requires also updating human resources capacity.

The possible contribution to training was presented from the UNESCO category II centers such as the regional center of training and water studies of arid and semi arid zones (RCTWS), ICHARM, ICIWaRM. A brief note about the United States National Weather Services was addressed.

First, Dr. Maha Tawfic, Director of the RCTWS presented the center facilities and the available training modules. The center has two missions. One on the local scale to bridge the gap between the skills and experience needed for a specific job and the human capabilities of the Ministry of Water Resources and Irrigation especially in the field of water resources planning and management. The second mission is on the regional scale to conduct different capacity building programs under the topic of integrated water resources management and related topics to meet the needs of engineers, agronomists, agro-economists and other technical staff in the Arab, Nile Basin, African and Mediterranean Countries.

The main objective of the center is to conduct high-quality training in Water Resources and relevant subjects, function as a regional center in the transfer and exchange of knowledge in the field of integrated water resources management, stimulate connectivity among knowledge institutions, and endorse regional networks for scientific cooperation, knowledge management and information exchange and to promote technical and managerial capabilities specially for underprivileged areas.

To achieve the abovementioned objective, the center holds several activities such as:

• Organizing and facilitating the exchange of information and knowledge on water management and development, including water use, water demands, and water resources availability, etc.
• Executing and carrying out activities in the field of institutional capacity building for educational and water sector institutions and organizations.
• Developing and implementing regional training and education programs in all relevant aspects of integrated water resources management and water-related sciences for various levels of expertise.
• Stimulating and carrying out regional exchange and outreach programs of decision makers, experts, trainers and other technical and non-technical staff.
The target groups of trainees are the water resources managers, professionals, engineers, agronomists/Agro-economists, technicians and administrative staff. The center is in charge of building the capacity of more than 100,000 employees of MWRI. The average number of national programs is 200 events/year and the average number of beneficiaries is 3000 trainees/year. The budget of the national program is supported by MWRI.

The center has five branches (1 Delta, 2 Middle and 2 Upper Egypt) and a ten acres campus, two main Buildings: one for the Lecture Rooms, Labs, Library and Administration, the other is a hotel with all necessary preparations and equipments.

Second Dr. Kamoto presented the possible contribution from ICHARM to the G-Wadi which is mainly the training modules and the registration in the short courses and the academic Ph.D and M. Sc programs. Again, Dr. Logan who represents the ICIWaRM repeated the available resources from the center that can contribute to the training which mainly the software and the technical assistant through the UNESCO available fund.

At the end, Dr. Shoroosh addressed the services that is provided by the NWS such as the real time data for rainfall through their website www.met.ed.ucar.edu

On day three of the meetings, it was planned to have a teleconference presentation about the WMO activities in flash flood risk management and their possible contribution to training. The presentation was given in day four but included here just to stay in line with the same topic of discussion.

Through a Tele conference, Dr. G. Teruggi, associated programme on flood management WMO presented the activities of WMO in flash flood risk management. WMO owns a series of training modules that could be used in the capacity building for the GWA such as (1) Hazard Assessment and Forecasting (Meteorology, Hydrology/Hydrologic, Modeling, Forecasting Systems, GIS/RS Modules and Hazard Assessment and Mapping Modules), (2) Risk/Hazard Communication and (3) Risk/Hazard Management (Structural Measures, Non-structural Measures, Multi-use IWRM strategies and Community-based Actions).

WMO developed the flash flood guidance system (FFGS) which is designed to be incorporated into NMHS operations and used along with other available data, systems, tools, and local knowledge to aid in determining the near-term risk of a flash flood in small streams and basins. It is implemented in Central America as the CAFFG system (operational since 2004) and available at http://www.wmo.int/pages/prog/hwrp/documents/FFGS4-May-2007.pdf.

The U.S. National Weather Service and the COMET Program developed the Flash Flood Early Warning System-Reference Guide. It provides an authoritative set of guidelines for the design and operation of successful flash flood early warning systems. Furthermore, it promotes the implementation of flash flood early warning systems, based upon proven and effective methods already in use in flash-flood prone nations around the world. It is available at http://www.meted.ucar.edu/hazwarnsys/haz_fflood.php.

Dr. Teruggi demonstrated some projects related to the Community Flood Management Programme (CFMP) in South Asia. Currently they are running a project on integrated flood management. The project has four main objectives such as (1) To provide support for the adoption of an integrated approach to flood management, (2) To provide Advocacy and Capacity Building for Integrated Flood Management (Tools, Trainings, Presentation Material),
To Provide Support for Field Demonstration Projects and (4) Provide Strategic advice on flood management through a Help Desk.

They have some tools for flood management which are still under development such as:

- Applying Environmental Assessment for Flood Management
- Conducting Flood Loss Assessment
- Formulating Basin Flood Management Plans
- Rapid Legal Assessment Tool
- Organizing Community Participation for Flood Management
- Reservoir Operations and Managed Flows
- The Role of Land-use Planning in Flood Management
- Urban Flood Risk Management
- Adaptation to Climate Change in Flood Management
- Guidelines on Flood Mapping
- Case studies on adaptation to Climate Change in Flood Management
- Flood emergency planning
- Transboundary aspects of flood management
- River restoration and wetlands conservation
- Flash Flood Management
- Mud Flows and Land Slides Management

From the above, it is clear that all the required resources for capacity building are available in the Arab region and through the international community such as the training facility, the training material, academic program and professionals either from the region or internationally. So, it is important to integrate all these resources into the GWA. Finally, WMO is interested in organizing new pilot projects in the Arab countries. Teruggi expressed his willingness to cooperate on the drafting of a flash flood manual.

Flash flood risk management meeting: Day 3 (27 September 2010)

The last session of the expert group meeting was devoted to discuss the training Curricula and Logistics. The session started by continuing the discussion about the training modules and the target group for each module. It was generally agreed that this is not a book about flash floods, but rather a publication for training trainers about flash floods. It was agreed that we should focus on a subset of the real gaps in the region (e.g., policy, data, systems, capacity building, and communications/social issues). Since we cannot solve all of these at once, participants decided that we should begin with the professionals, who can extract materials for students, policy makers, and others. Given that, we can assume a basic knowledge of hydrology on the part of the participants.

As for the content of the manual, there was discussion of issues such as:

- Where and how socio-economic and legal issues should be covered;
- The level of detail for topics such as modeling adaptation to climate change (with a sense that we shouldn’t get too detailed on such topics);
- Best use of flood frequency and storm frequency statistics, and paleoflood hydrology, for flash floods;
• Highlighting the importance of a basin authorities;
• Quality control of data (e.g., meteorological, hydrological);
• Communication of flood warnings, including institutional arrangements; and
• Adding case studies on a CD for participants to choose from for their own training courses.

Based on these discussions and an initial draft, an approximate thematic outline of the course was prepared. Following this, participants designed a road map (timetable and some assignments) to prepare the materials:

1. Bisher Imam takes the lead on polishing the report outline, with assistance from others such as Abdin Saleh and Soroosh Sorooshian;
2. The outline will be circulated to participants and others involved in G-WADI; ideally this would be finished within about 2-3 weeks;
3. A joint proposal would then be submitted to sponsors;
4. Potential sponsors who were present were queried as to the likelihood of financial support. (The following does not represent formal institutional commitments.) The UNESCO regional office agreed to fund the basic expenses of the manual and the IHP Secretariat will provide mostly in-kind services. ALECSO expressed an interest in continuing to support the project, and agreed to help recruit other partners through their network. ISESCO indicated a likelihood of financial support for training. RCTWS has training labs and facilities that they will likely be able to contribute “in-kind”. ICHARM and ICIWaRM did not make specific commitments but agreed to help make sure the manual and training course happen. WMO was not present in the discussion, but based on their later presentation seems likely to assist at least on an in-kind basis.
5. It was agreed that we will develop the manual whether we find all the money for training or not;
6. We will aim to put the manual together in 6 months to a year;
7. Pending funding, a likely venue is the RCTWS in Cairo, hopefully in the first half of 2011. They can accommodate a maximum of 24 in their labs, but one could perhaps have parallel training sessions to increase the numbers. They have lots of classrooms, with capacities of up to 80 people, so that is not a limitation.

Those present discussed who the target group for the training course is. It was generally agreed that ideally
• There would be more than one person per country and from most of the Arab countries (although we may be limited by finances);
• It would be good to have some people from national weather services (who can talk about meteorological and satellite data and how to make use of it), some hydrologists, some professionals with experience in floodplain mapping and GIS, some regional experts, and some social scientists with a good knowledge of water.
• There should be a minimum set of requirements for participants; they should come prepared with some kind of information about flash flooding in their own country, for example.
• Participants should be asked to make some sort of commitment to training others afterwards.
• We should create an “ideal” profile for the participants. Qualifications such as BS or MS, working knowledge of “x”, “x” years experience working on applied problems in the field, proficiency in the language of instruction, experience in and/or enthusiasm for teaching others, commitment to advance preparation for the course, etc. But we cannot be too limiting, because each country is different.
• We would prefer people actively working in the field to academics.
• We should make sure we learn from previous experience in training-the-trainer workshops (e.g., the Iranian urban water management center).

A concluding summary of the main recommendations that were evolved from the discussion and deliberation are as follows:

1. UNESCO Cairo-Office takes the lead to launch the G-Wadi Arabia (GWA) which will be a great potential for more cooperation between the Arab professionals. It also responds to the real challenges and priorities of the Arab region
2. Hire a consultant to identify the available potential in the region to start the GWA.
3. Within the context of the Arab Region, it is recommended to conduct an assessment for the existing resources within the G-Wadi Network and the IHP program (training material, training facilities, and professionals);
4. Tailor a training manual for TOT to meet the needs of the Arab Region;
5. Establish GWA network through an initial launching of a website to share knowledge and expertise and to disseminate the challenges of the flash floods in the Arab Region;
6. Develop a pilot project for collaboration on data and expert exchange (Egypt, Jordon (UNESCO-Jordon), Sultanate of Oman…etc);
7. Lobbying with governments and policy makers to secure funding from governments and other bilateral funding sources for GWA activities in the region.
Appendix A
Meetings’ Agenda
G-WADI meeting (24 September, 2010)
Flash Flood Risk Management Expert Group Meeting (25-27 September 2010)
Cairo, Egypt

Draft Agenda

08:30-09:00 Registration
09:00 -10:00 Opening Ceremony

Chair : Tarek Shawaki
09:00-09:40 Opening of the meeting:
- Tarek Shawki, Director of UNESCO Cairo Office
- Hatem Mekhemer, ISESCO
- Abulgasem El Badri, ALECSO
- H.E. Mohamed Nasr El Din Allam, Minister of Water Resources, Egypt

09:40-09:50 Historical background of G-WADI initiatives and needs for Flash Food Risk Management in the region- Abdin Salih

09:50-10:00 IHP activities and recent developments - Anil Mishra

10:00-10:30 Coffee Break

10:30 - 17:30 G-WADI expert session
Chair: Soroosh Sorooshian

RAPPORTEUR: Mike Edmunds supported by R. Jayakumar, B. Imam, Abdelaziz Zaki and Anil Mishra

10:30-10:40 Self introduction of participants

10:40-11:00 Key note: G-WADI networking: opportunities and challenges – Soroosh Sorooshian

11:00 -13:00 G-WADI Programme, Cooperation and Regional Activities

11:00-11:20 G-WADI Geo Server: UNESCO- CHRS cooperation- Soroosh Sorooshian and B. Imam

11:20-11:40 G-WADI and ICIWaRM cooperation: Will Logan

11:40-12:00 Experiences from Asian G-WADI Network and representative basins - R. Jayakumar, KD Sharma
12:00-12:20  G-WADI in Africa - Mike Edmunds, Abdin Salih and Abou Amani

12:20-13:00  Proposed G-WADI Network in Arab Region
   Moderator – Abdin Salih, Bisher Imam, Anil Mishra, Abdelaziz Zaki

13:00-14:00  Lunch

14:00-15:00  Linkages with other programme, centers and initiative
   Moderator: Anil Mishra
   Panelist:
   • ACSAD (Abdulla Droubi)
   • ISESCO (Hatem Mekhemer)
   • ALECSO (Abulgassem El Badri)
   • ICHARM (Ali Chavoshian)
   • ICIWaRM (William Logan)
   • GWPN (Ahmed Khater)
   • RCTWS (Maha Tawfik)

15:00-16:00  Discussions, concluding remarks and recommendations

16:00-17:30 G-WADI: Strategy and Objectives and Future Direction

16:00-16:30  G-WADI: Strategy and Objectives and future direction
   Panelist – Soroosh Sorooshian, Abdin Salih and Mike Edmunds

16:30-16:45  Coffee break

16:45-17:15  Discussions

17:15-17:30  other matter

17:30  Closer of the meeting (Soroosh Sorooshian)
Saturday 25 Sep. 2010

Session I: Regional Case Studies I

CHAIR: Abdullah Droubi and Mike Edmunds
RAPPROTEUR: Abdelaziz Zaki

09:00-09:20 Introduction to the Meeting: Objectives, activities and expected outputs (Bisher Imam, Anil Mishra and Abdelaziz Zaki)

09:20-11:20 Country Presentation-Case study presentations on Flash flood risk management in the Arab region: previous experience, problems and success stories (ACSAD, Egypt, Sudan, Saudi Arabia)

11:20 - 11:45 Coffee Break

11:45- 13:00 Country Presentation-Case study presentations on Flash flood risk management in the Arab region: previous experience, problems and success stories (Oman, Libya, Yemen)

13:00-14:00 Lunch

Session II: Regional Case Studies II

CHAIR: Abdulaziz Al-Turbak and John Cools
RAPPROTEUR: Bisher Imam

14:00- 15:30 Country Presentation-Case study presentations on Flash flood risk management in the Arab region: previous experience, problems and success stories (Jordan, Tunis, Algeria)

15:30- 16:45 Discussion
Existing Capacities and Major Challenges

16:45-17:00 Coffee break

17:00-17:30 Conclusions, Wrap and Tasks for Day 3 (RAPPROTEURES/CHAIRS)
Sunday 26 Sep. 2010

Session III (Flash Flood Forecast and Risk Management I)

CO-CHAIRS: Waleed Al-Zubari and Soroosh Sorooshian
RAPPORTEUR: Bisher Imam

09:00-09:30 Rainfall System of the Arab Region (Mohamed AbdelRahman)
09:30-10:00 Discussion
10:00-10:45 Overview of Flash Flood Warning Systems Presentation and Discussion (Bisher Imam)
10:45 - 11:00 Coffee Break
11:00- 13:00 Technical Presentations from the international partners and Experts (ICHARM, ICIWaRM, WMO, SORESMA)
13:00-14:00 Lunch

Session IV : Need Assessment and Possible Contributions

CO-CHAIRS: Sameh Sakr and Abdin Salih
RAPPORTEUR: Abdelaziz Zaki

14:00- 15:30 Discussion
   1. Gaps (Data, Systems, and Human Resources)
   2. Training Needs and Priorities
   3. Potential Partnerships and Role of Partners
15:30-15:45 Coffee Break
15:45-17:15 Possible Contributions to Training
   • Regional Center of Training and Water Studies of Arid and Semiarid Zone.
   • ICHARM
   • WMO
   • ICIWaRM
   • Others (US-NWS, SORESMA, and others).
17:15-17:30 Conclusions, Wrap and Tasks for Day 4 (RAPPORTEURS/CHAIRS)
Monday 27 Sep. 2010

Session V : Training Curricula

Co-CHAIRS: Abdulla Noaman and Soroosh Sorooshian
RAPPORTEURS: Bisher Imam, Abdelaziz Zaki

09:00-11:30 Training Modules Discussion (Possible Topics)
Hazard Assessment and Forecasting
- Meteorology
- Hydrology/Hydrologic Modeling
- Forecasting Systems
- GIS/RS Modules
- Hazard Assessment and Mapping Modules

Risk/Hazard Communication:
Risk/Hazard Management
- Structural Measures
- Non-structural Measures
- Multi-use IWRM strategies
- Community-based Actions

11:30 – 11:45 Coffee Break

11:45- 13:00 Training Modules Discussion – Continued
13:00-14:00 Lunch

Session VI: Training Logistics

Co-CHAIRS: Maha Fahmi and Abdin Saleh
RAPPORTEUR: Bisher Imam and William Logan

14:00- 15:40
- Training/Training the Trainers Profile of the participants
- Training requirements (Computer Lab, Software)
- Date and Venue

15:40- 16:00 Coffee Break

16:00-17:00 Wrap-UP, Conclusions, Recommendations, and Next Actions
Abdin Salih and Soroosh Sorooshian.
Appendix B
List of Participants
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<tr>
<th>No</th>
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Opening Speeches
Appendix C

Opening Speech of Dr. Tarek Shawki,
Director, UNESCO-Cairo Office
Your Excellency, Prof. Mohamed Nasr El Din Allam, Minister of Water Resources and Irrigation of Egypt

Honorable and Distinguished Guests, Colleagues, and Participants,

I am indeed honored and pleased to address this distinguished gathering on the occasion of the opening ceremony of the GWadi meeting and Flash Flood Risk Management Expert Group Meeting.

In the name of the Director General of UNESCO, Ms. Irina Bokova, allow me to express our gratitude to H.E. Prof. Mohamed Nasr El Din Allam to be with us today in the opening of the meetings. Also, I am so grateful to those eminent scientists and guests who came a long way to join us here today and I wish them every success in their forthcoming debates and discussions.

The topics of the meetings and its themes deserve all our interest and attention since water is one of the vital issues that affect us all. We assure you all our full support and commitment to implement all relevant recommendations that would result from this important meeting.

Ladies and Gentlemen,

Almost daily we hear that massive disaster has impacted human life and property somewhere on the planet. Severe earthquakes, cyclones, and floods cause widespread devastation and generate sensational images for months or even years after their occurrence.

Flash floods are the most lethal form of natural hazard, and causing huge annual lose in terms of damage and disruption to economic livelihood, business, infrastructure, services and public health. On the other hand, poor water management coupled with lack of adequate emergency management institutions and infrastructures reduce the societal capacity to cope with extreme flash floods and increase their risks. Understandably these types of hazards captivate the attention of policy makers and the general public, many of whom are directly impacted by such events.

The Arab region is the most water-scarce region of the world. Water management problems are already apparent in the region. Aridity, low rainfall, high evaporation, uneven distribution of water resources, complexity of the hydro-political conditions, the rapidly growing human population, the deterioration of water quality and the accelerated demand for water are key...
factors contributing to water resources vulnerability in the Arab Region. Recently during 2009 and 2010, different parts in the Arab region were subjected to heavy rain storms leaded to flash floods. People were killed, power lines were knocked out and roads were destructed in Aswan and Al-Arish cities in Egypt, Jeddah and Riyadh cities in Saudi Arabia and Gaza in the Palestinian Territories in addition to many other areas in the region.

Flash floods risk assessment forms the core of the disaster risk management process and results in the identification of potential risk-reduction measures in the Arab region. The integration of risk assessment into the development planning process is highly needed to identify actions that both meet development needs and reduce risk. Identified risk-reduction actions should be incorporated into development policies in the Arab region.

The magnitude of flood damage in the Arab region, combined with the uncertainty in current estimates of flood risk, suggest that we could benefit from improved scientific information and build capacities for flash flood risk management. We need more adequate understanding of the processes causing flash floods and more exchange of knowledge on flash flood risk management measures at institutional levels. Building the capacity of those working and dealing directly with flash flood will help to reduce flash flood risk in the region.

Distinguished participants

UNESCO’s International Hydrological Programme is actively engaged in fostering science and knowledge for addressing regional priorities and responding to water management challenges. Accordingly, UNESCO in joint collaboration with ISESCO and ALECSO organize the GWadi meeting and Expert group Meeting on “Flash Flood Risk Management”. The main purpose of these meetings is to discuss launching G-WADI Arabia and to discuss the executive procedures for the preparation of training manual on “Flash Flood Risk Management” to be conducted in a “training of trainers” workshop in 2011, which I hope that it will be a platform of more cooperation between all participating partners and stakeholders.

In closing, please allow me to reiterate once more that it has been my pleasure to be here with you and I assure you our full support to all your recommendations.

I must take this opportunity to express my great appreciation to our long-term partners: ALESCO and ISESCO for supporting these important meetings. The close cooperation among us is highly appreciated and I am sure that it will finally lead to a fruitful and better water resources management in the Arab Region.

Thanks are extended to my UNESCO colleagues at Headquarters and Cairo Office for their continuous efforts for the preparation and organization of these meetings.

Also, I would like to extend my thanks and gratitude to the Ministry of Water Resources and Irrigation of Egypt and H.E. Prof. Mohamed Nasr El Din Allam for their continuous support and cooperation.

I wish you a fruitful deliberation and a successful conference.
Thank you.
Appendix D

Opening Speech of Dr. Hatem Mekhemer, ISESCO Representative
Message of

of

of

the Islamic Educational, Scientific and Cultural Organization -ISESCO-

at the Inaugural Ceremony of the

International Experts Meeting on Wadi Hydrology

24 – 27 September 2010
Cairo, Egypt

In the Name of Allah, Most Gracious, most Merciful
Honorable ………………… Representative of the United Nations Educational, Scientific and Cultural Organization (UNESCO),

Honorable ………………… Representative of the Arab League Educational, Cultural and Scientific Organization (ALECSO),

Distinguished guests,

Ladies and Gentlemen,

Assalamu Alaikum Warahmatu Allah Wabarakatuh,

It is a great honor and pleasure for me to convey to you the greetings of His Excellency Dr. Abdulaziz Othman Altwaijr, Director General of the Islamic Educational, Scientific and Cultural Organization (ISESCO) and wishing you all success in discussion and achieving the objective set of the meeting. I have the pleasure to welcome you to this International Meeting on Wadi Hydrology which is being organized in cooperation with the UNESCO and ALECSO.

First of all, I would like to thank the UNESCO - Cairo Office and ALECSO for taking initiative in organizing this important International Meeting in joint collaboration with ISESCO in the beautiful environment of Cairo. My thanks also go to other partners who extended their support to this important International Meeting. During the last two decades, research efforts and networking are contributing to the enhanced state of knowledge of hydrology of arid areas, especially Wadi system. ISESCO in partnership with UNESCO and ALECSO has always remained active in organization of the WDI Hydrology Program since the initial efforts of implementation of First International Conference on Wadi Hydrology in Sharm El-Sheikh (November, 2000) and the Second in Amman (July, 2003) and the Third in Sana’a (December, 2005) as well as the fourth in Muscat (December, 2007). I am confident that the vision, thought and new methodologies expected to be discussed at this International Meeting would further expand our insight and enhance our capacities towards integrated management of water resources, especially under Wadi Hydrology programme.

Distinguished guests,

Ladies and Gentlemen,

Scarcity of fresh water resources has always remained an issue of concern in the Islamic countries. Water scarcity and deterioration of water quality in most of the Islamic countries is not
only hampering their socio-economic development process but also threatening their very existence especially due to its relations with other critical factors like poverty, food and nutrition, and health. This water deficit in Islamic countries is expected to enhance many times in the next decade especially due to climate change, deterioration of the environmental conditions and the appearance of the phenomena of green house gases. Increase in water pollution is causing a real threat to human and it is a major cause of concern for the Islamic countries especially in the African region. Water tables have already dropped dramatically and readily available water resources will be exhausted within the next 20 years unless consumption of fresh water is economized. It is necessary that we develop sustainable solutions through the promotion of integrated management of water resources and take all precautionary measures to protect the biosphere in order to fulfill our moral obligations and responsibilities towards our future generations. The water provided by Almighty Allah is sufficient to meet our current and future demands provided that we manage it in a sustainable way.

Sustainable management of water resources in the Islamic world, both fresh water and coastal as well as marine, has remained one of the prime objectives under ISESCO various medium and short term action planning. Under ISESCO Water Programme a Strategy for Management of Water Resources was adopted by the second Islamic Ministerial Conference held in Tripoli, Great Socialist People's Libyan Arab Jamahiriya, in September, 2003, and was approved by the 10th Session of Islamic Summit Conference held in Malaysia, in October, 2003. Basic principles of this Strategy are that: fresh water is limited resource, essential for life continuity, therefore, needs to be protected, adequate supplies of good quality water must be maintained for all population, integrated water resources management is a collective responsibility of all, therefore, it is extremely important to increase water awareness to preserve it from pollution. An implementation mechanism of the Water Strategy as well as the General Framework of Islamic Agenda for Sustainable Development has been adopted by the Third Conference of Environment Ministers (ICEM-3), held at Rabat, Morocco Kingdom, in October, 2008 which is now under implementation. During the next few days ISESCO will held the fourth Conference of Environment Ministers (ICEM-4) in Tunisia, Republic of Tunisia at the from 5–6 October 2010. The main topics which will be discussed are water resources management, protection of the environment, renewable energy and sustainable development.
Distinguished guests,

Ladies and Gentlemen,

Water is essential to life and sustainable development. ISESCO has exerted to build up capacities of the Member States in effective and sustainable management of water resources, while giving special attention to water resources management for human needs. For many countries, the development and efficient utilization of renewable resources of water in Wadi is the only optimal solution for addressing water shortage problems. Population growth and the extended settlements in and around Wadis increase human and environmental problems especially those related to flash floods. The efficiency of harvesting water from Wadis depends on the understanding and knowledge regarding the qualitative and quantitative hydrology and water resource potentiality of the Wadi system. The natural scarcity of water in the arid and semi arid regions, where most of Islamic countries are located, is further aggravated by man-made factors. The natural scarcity comes from low rainfall, aridity, high evaporation rates, and widely random temporal and spatial variation in the occurrences and distributions of surface and groundwater resources. Large floods are common and recharge events are difficult to quantify, in addition, much water is abstracted from non renewable aquifers.

The main objectives of the EGM are to present the case studies on flash flood risk management in the Arab region with special focus on previous experience, problems, gaps and success stories. Define the structure of a training manual on Flash Flood Risk Management to be conducted during 2011 with the involvement of all attended institutions and experts. Assign tasks, responsibilities and timetable for the training manual preparation.

Distinguished quests,

Ladies and Gentlemen,

Before concluding, I would like to express thanks and appreciation to ALECSO, UNESCO, for their support and cooperation in organizing this important event.

I would like to extend my thanks to all member of the Organizing Committee for their efforts, and excellent management of this Meeting.
Last, but not least, I would like to thank all the distinguished guests, honorable scientists for their efforts exerted in preparing their representation contributing towards the success and achievement of the objectives of this International Expert Meeting and would like to wish you have a nice stay in this nice city Cairo.

I wish you fruitful deliberations and thanks for your kind attention.

May Allah bless our efforts with success.

Wassalamu alaikum warahmatu Allah wabarakatuh.

H.M
Appendix E
Opening Speech of Dr. Abulgaseem El Badri, Representative of ALECSO
كلية د. إبراهيم العامية

الأمانة العامة

الresultado de la consulta...
الأمامة العامة

[النص العربي غير قابل للقراءة]
Appendix F

Speech of H.E. Dr. Mohamed Nasr El Din Allam, Minister of Water Resources and Irrigation
Opening Speech
H.E. Prof. Dr. Mohamed Nasr Allam
Minister of Water resources and Irrigation

H.E. Prof. Mohamed Nasr El Din Allam, Minister of Water Resources and Irrigation would love to personally inaugurate and participate in this event but due to some other official obligations and commitment he asked me to express his excuse and to convey his best regards to all the distinguished participants.

Dr. Tarek Shawki, Director, UNESCO-Cairo Office
Dr. Hatem Mekhemer, ISESCO Representative
Dr. Abulgasem El Badri, ALECSO representative
Experts and Colleagues

Good Morning

It is an honor to be here among such intellectual team to inaugurate the G-Wadi meeting and the expert group meeting on flood risk management.

First, I’d like to draw your attention that Egypt is suffering a water shortage that increases gradually. Away from the Nile and especially in the Eastern Desert and Sinai, Renewable water resources are limited to the very little amount of rainfall that causes in some cases flash floods. These floods if properly managed, will serve the needs of the fragile communities located in the desert. Furthermore, social stability and economic development are highly tied to the sustainable existence of the water resources.

We are all aware of the geographic dimensions and the natural complexity of Sinai Peninsula. Sinai is the land of religion, mercy and peace. However, the scarce fresh water resources in this area slow down the development and sustainability. Yes, Sinai is bounded from everywhere by tremendous renewable water resources but unfortunately; they are saline and are not suitable to fulfill the required water demands. Desalination is an option to meet the water demands. The existing resorts along the Red Sea coast have already shown good examples of utilizing the desalination technology. Nevertheless, the complexity of the topography and the wide scattered population distribution in Sinai hinder the transportation of the desalinated water in-land to serve the nomads and the small communities. The same is applied for any other sources of water. Therefore, different options are addressed in the MWRI policy:

Groundwater: it does exist with different quality and at different depths below the ground surface. Despite the low recharge rate from the rainfall, the available groundwater is considered as non-renewable and is managed as a strategic reserve. The high salinity of the available groundwater and the high cost of drilling and pumping are major constraints for the sustainable development of this precious resource.

It is worth mentioning that over the past two decades, a continuous decline in the ground water levels and an increase in the water salinity were observed. These two threatening parameters led to the abandoned of many wells and people were affected socially and economically. Therefore, the MWRI with full participation from the stakeholders and beneficiaries should work together to mitigate the impact of such deterioration in an effective manner. Through innovation and adapting low cost technology, scientists, researchers and water users could do better to improve the existing situation.
Rainfall and surface water harvesting: Since the ancient time, rainwater harvesting was the only source to provide people with water. Flash floods are among the most disastrous natural phenomenon and at the same time an important source of water in Sinai. To the best of their knowledge, the Bedouins explored all kind of techniques and technology that enabled them to survive during the past centuries. Since the advent of the modern technology, scientists and engineers learned from the local inhabitants and adapted their techniques into the water harvesting projects.

Starting from the rainfall prediction and the surface runoff estimation, Bedouins have the insight capabilities and knowledge to manage the rainfall.

With the full involvement of the stakeholders, the MWRI constructed 51 water-harvesting structures in Sinai. Up to Year 2017, the ministry will support establishing 150 water storage structures with a total estimated cost of LE 200 millions. These facilities vary between small underground storage tanks and medium size dams. Despite their small storage capacities, they are highly effective in securing the water over the year for the fragile-scattered communities. Furthermore, the water storage structures serve another function, which is the protection of the livelihood and the infrastructures from the massive destruction of the flash floods.

With the recent socio-economic development in Sinai in terms of infrastructures (roads, natural Gas and oil pipelines, airports, harbors, resorts and settlement…etc), flash floods cause severe damages to the human lives and the infrastructures.

Scientifically, Rainfall events in arid areas are hard to forecast, as they are irregular, highly variable in space and time and often highly localized. In addition, understanding the hydrology and hydraulics of the wadis are challenging due to insufficient insights in the response of wadis to rainfall events.

Therefore, Early Warning Systems (EWS) can provide additional lead-time, which may reduce damages. The joint cooperation between the Government of Egypt and the European Commission through the Life project has created such warning system in place. The developed partnership of this project has shown that scientists from different countries can work together to learn from each other and at the end to help the poor and the needy people.

The last flood that Egypt had experienced in January 2010 has proved that a lot is still to be done in order to better utilize our water resources and to protect our infrastructures crossing the flood hazardous zones.

The MWRI has taken some positive measures to manage the flood risks. Among those are:

- Developing a flood atlas for all Egypt
- Registering the Early Warning System as a tool for the daily management of the possible floods
- Developing an engineering code for the construction in flood hazardous zones
- Expand our water harvesting strategy to meet the demand of the communities located away from the Nile.

Having said that, it is time to learn and work with each other through knowledge exchange to lessen the destructive impact of the flash floods and to maximize the utilization of the runoff before losing the water in such arid areas.
Finally, I wish you a successful meeting to achieve your objectives and we are grateful to UNESCO for their continuous support to face our water challenges.
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