Conceptualization of flow in a snow-governed groundwater catchment in Lebanon: A science-based approach for future guidelines for sustainable water management

PROGRESS REPORT III: SNOW AND FLOW WEBINAR

SUMMARY REPORT

SUBMITTED TO:

UNICEF

Prepared by:

AMERICAN UNIVERSITY OF BEIRUT

DEPARTMENT OF GEOLOGY

Dr. Joanna J. Doummar

Mr. Jihad Othman

Mr. Mohamad El Ali

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1. BACKGROUND

The American University of Beirut (AUB) was awarded a Grant by UNICEF to conduct a project titled: "Conceptualization of flow in a snow-governed groundwater catchment in Lebanon: A science-based approach for future guidelines for sustainable water management", in collaboration with Saint Joseph University in Beirut (USJ).

The study consists of undertaking a monitoring campaign on poorly investigated springs in the area of Kfarzebbiane in Mount Lebanon to quantify flow at a high resolution and the currently available quantities for supply for decision-makers. Besides, it includes a geological reconnaissance, mapping, as well as tracer experiments to allow the characterization of the catchment area of the investigated springs for a better understanding of the system in terms of flow preferential paths, velocities of transport in case of contamination, and delineation of contribution zones. The processing of collected high-resolution data and mapping outcomes aims at a better conceptualization of the system and the expected quantities. The latter can be implemented in advanced vulnerability and protection maps, in the evaluation of spring responses to climate change scenarios or snowmelt. All of these results will be disseminated via informative maps, flyers, and workshops to local stakeholders and decision-makers to help them make science-based decisions in the future to address water deficit issues that are yet to arise under climate change conditions. This report (Report III) presents a summary of the Webinar prepared by AUB and presented by all project partners dedicated to launching the project Snow & Flow.

2. WEBINAR ANNOUNCEMENT

2.1 WEBINAR RATIONALE

The webinar aims at launching the project Snow and Flow and presenting to the stakeholders, water decision-makers, international and national water professionals, academics, and students the main activities included in the project Snow and Flow funded by UNICEF and conducted by two research teams from Saint Joseph University (USJ) and the American University of Beirut (AUB) as follows:

- "Monitoring of annual and inter-annual snow cover fluctuations in the summit areas of Kfarzebbiane and their effect on water resources" by USJ
- "Conceptualization of flow in a snow-governed groundwater catchment in Lebanon: a science-based approach for future guidelines for sustainable water management" by AUB

The webinar aimed also at raising awareness about the overall snow-groundwater relationship in a karst-dominated system to be able to understand future demands and constraints and allow science-based decisions for better management of groundwater resources.

2.2 ANNOUNCEMENT

Faculty of Arts and Sciences
Department of Geology

Invites you to

SNOW AND FLOW
webinar

November 3, 2020
11:00 am–12:30 pm

click here to join!

webex

Relationships between snow and groundwater flow in mountainous areas:

Applications to Laban and Assal Springs (Mount-Lebanon)

Freshwater, notably groundwater is currently facing tremendous stress due to climate change and climate variability in addition to the increase in water needs and demands, especially in semi-arid regions. As a result, various water management measures have been proposed in the last decades to overcome projected water scarcity and outline alternatives resources for water. However, water supply sustainability is highly dependent on the proper conceptualization of the water resources and the climatic conditions for an appropriate projection of water availability in the future.

For this purpose, this webinar introduces the activities to be undertaken by the American University of Beirut (AUB) and Saint Joseph University (USJ) in the framework of two symbiotic projects:

- Monitoring of annual and inter-annual snow cover fluctuations in the summit areas of Kfardebiane and their effects on water resources **(USJ)**
- Conceptualization of flow in a snow-governed groundwater catchment in Lebanon: A science-based approach for future guidelines for sustainable water management **(AUB)**

Program

11:00-11:05:	**Welcome note.** *Joanna Doummar, AUB*
11:05-11:15:	**Introduction of the project.** *Mehdy el Zoubaidy, UNICEF*
11:15-11:30:	**Snow research activities** *Charbel Abou Chakra, Janine Somma and Laurent Drapeau, USJ*
11:30-11:40:	**Relationship between snow and groundwater.** *Wajdi Najem, USJ*
11:40-12:00:	**Subsurface characterization and conceptualization of groundwater flow** *Joanna Doummar, AUB*
12:00-12:10:	**Project Impact and Importance: future work.** *USJ and AUB*
12:10-12:30:	**Discussion, Q&A: Concerns and Expectations.** *Moderators: Panelists*

3. WEBINAR DETAILS

3.1 DETAILS

The general details about this webinar are shown below:

- **Date:** 3 November 2020
- **Time:** 11:00 am – 12:30 pm
- **Venue:** Online using WebEx meeting tool

3.2 PANELISTS

- UNICEF: Mehdy Al-Zoubaidy
- USJ team: Wajdi Najem- PI (USJ); Janine Somma, and Charbel Abou Chakra (USJ); Laurent Drapeau (O-Life)
- AUB team: Joanna Doummar – PI (AUB) and moderator; Researchers: Mohamad Alali and Jihad Othman

3.3 ATTENDEES

A total of 24 participants attended the Webinar (Table 3-1). The distribution per sector is provided in Figure 3-1.

Table 3-1 List of participants and their affiliations (as recorded from the Webex Platform)

	Entity	Name	Type of Institution
1	Beirut and Mount Lebanon Water Authority	Antoine Zoghbi	EBML
2	BTD	Saeed Mhanna	Private sector
3		Abed Hajj	Private sector
4	Ministry of Water And Energy	Suzy Howeiyek	Public Institution
5		Benoit Fahed	Public institution
6	LEWAP	Jasmine Al Kareh	Private institution
7	Issam Fares Institute, AUB	Nadim Farajallah	Academic Institution
8	ESCWA	Tracy Zaarour	UN Agencies
9		Ziad Khayat	UN Agencies
10	SDC - Lebanon	Michelle Jalkh	Cooperation agency
11		Urs	Cooperation agency
12		Ramzi Ibrahim	Cooperation agency
13		Pierre-Yves	Cooperation agency
14	CNRS L	Ali Monzer	Cooperation agency
15	UNICEF	Hussein Fakih	Academic Instit.
16	UN Agencies	Kevin Bonel	UN Agencies
17	UN Agencies	Charbel Hanna	UN Agencies
18	Student AUB	Roukaya Eid	Academic institution
19	Student USJ	Laurent Kupelian	Academic institution
20	Assist. Prof. USJ	Christiane Zoghbi	Academic institution
21	Academic institution	Naiade Adame	Academic institution
22	Other	Ghassan Ghattas	Other

	Entity	Name	Type of Institution
23	Reconciliation officer. H2O	Gomez Adrien	Reconciliation officer. H2O
24	Other	Elie Abou Jaoude	Other

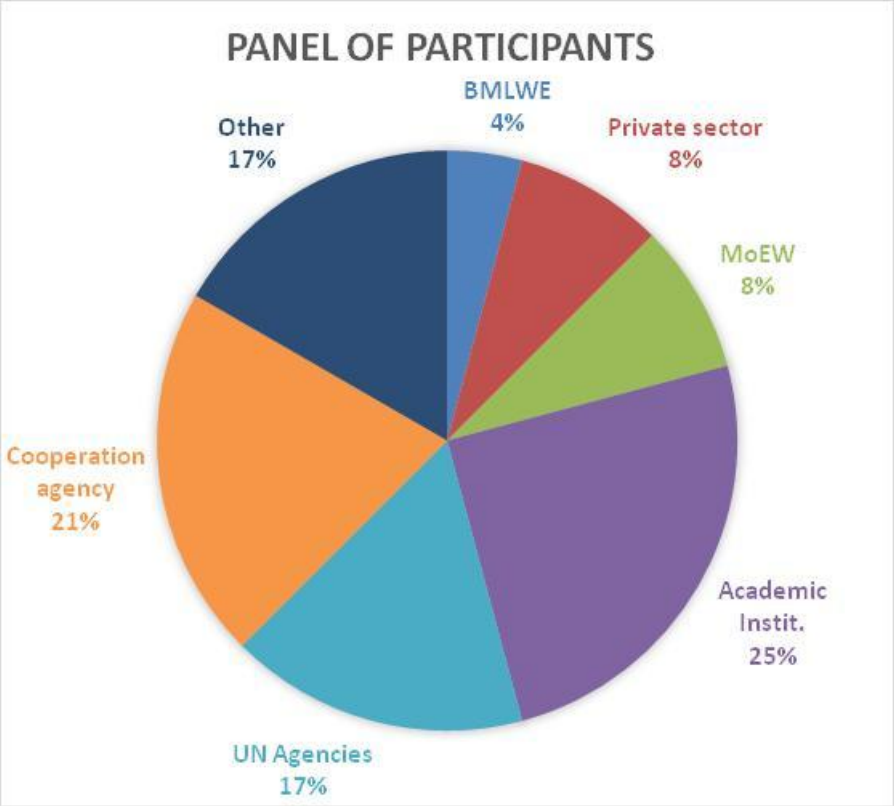


Figure 3-1 Distribution of participants per affiliation (courtesy of *Mehdy Al Zoubaidy*)

4. PROGRAM AND SCHEDULE

4.1 SCHEDULE

The webinar consisted of seven sections:

- **11:05-11:15:** Introduction of the project (*UNICEF: Mehdy el Zoubaidy*)
- **11:15-11:30:** Snow research activities (*USJ: Charbel Abou Chakra and Jeanine Somma & O-life: Laurent Drapeau*)
- **11:30-11:40:** Relationship between snow and groundwater (*USJ: Wajdi Najem*)
- **11:40-12:00:** Subsurface characterization and conceptualization of groundwater flow (*AUB: Joanna Doummar*)
- **12:00-12:10:** Project Impact and importance: future work (*USJ and AUB*)
- **12:10-12:30:** Discussion, Q&A: Concerns and Expectations (*Moderators: Panelists*)

4.2 EVENT

1- Welcome Note: *Joanna Doummar*

2- Introduction to the Project: *Mehdy Al-Zoubaidy*

In this section, Mehdy Al-Zoubaidy introduced the background and rationale behind the project by explaining the importance of groundwater resources and the risks of endangering these resources. He also presented the area of interest (Kfarzebbiane) and explained the tasks that will be completed by both AUB and USJ teams to fulfill the objectives of this project.

3- Snow Research Activities: *Janine Somma, Laurent Drapeau, and Charbel Abou Shakra*

Laurent Drapeau started this part by introducing the snow monitoring concept using the snow observatories installed in multiple locations in Mount Lebanon, the types of data collected, and the use of this data (O-Life).

After that, Janine Somma and Charbel Abou Shakra presented how aerial photographs, enhanced DEMs, and steady cameras are used to map dolines, identify doline alignments, estimate snow volume, and describe the infiltration of snowmelt through dolines. They also discussed the use of the data and models for predictions and forecast purposes.

4- Relationship between Snow and Water Resources: *Wajdi Najem*

In this section, Wajdi Najem presented based on historic data the relationship between snow and water resources by comparing and correlating snow volume and snowmelt data with spring water data.

5- Subsurface Characterization and Conceptualization of Groundwater Flow: *Dr. Doummar*

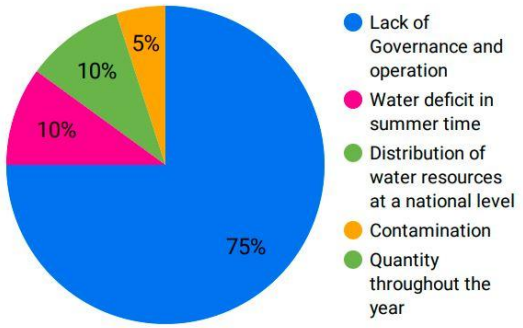
In this part, all previously discussed concepts were linked together to describe the big snowmelt-groundwater system in a karst setting. Joanna Doummar started by discussing the risks faced by the groundwater resources and the importance of addressing them. Followed a list of methodologies used to assess water quality and quantity in karst through high-resolution data collection, and extensive field experiments. Also, she emphasized the importance of monitoring networks for data collection and explained how this data can be used to achieve the purpose of this study.

6- Survey

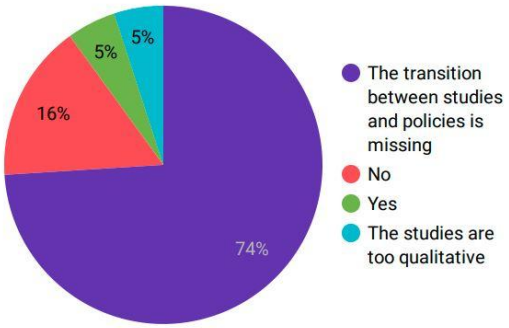
To spread awareness and promote the concept of sustainability, A survey has been implemented during the webinar to collect data and opinions from the attendees about water-related issues in Lebanon. This survey was conducted for six minutes after the presentations, using the WebEx Polling tool. It consisted of six questions with multiple answers.

The results of this survey were recorded and analyzed as shown below:

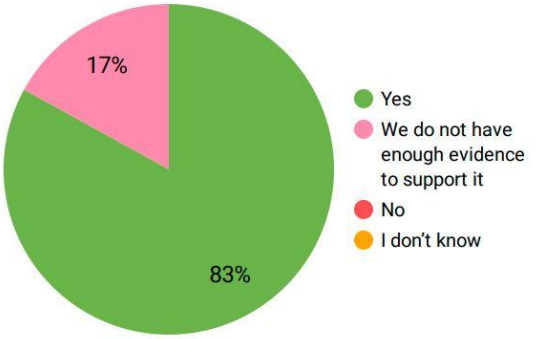
1- What is the most important pressing problem of water resources in Lebanon?



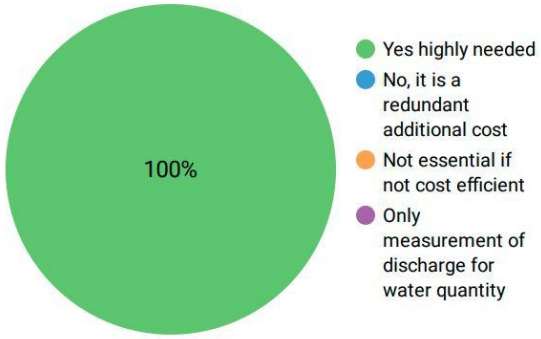
2- Do hydrogeological studies in Lebanon provide enough evidence to support updates and changes in policies for a better management of water quality and quantity?



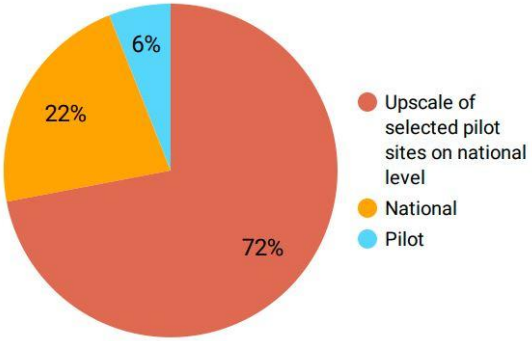
3- Do you think that Climate change and variability will impact groundwater resources in the future?



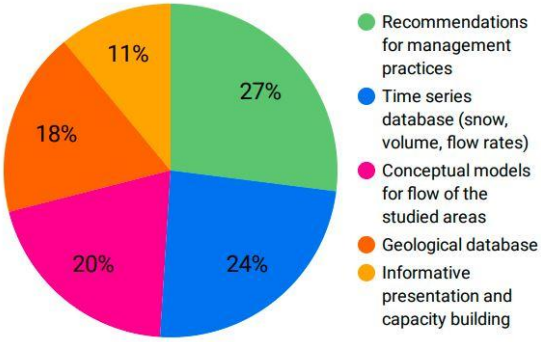
4- Do you think that the continuous monitoring of water resources (multi parameters and discharge) is essential for water management purposes?



5- Do you think that the management of water resources requires studies at a national or pilot level?



6- What do you expect as an outcome from this study? (Multiple selections allowed)



7- Discussion, Q&A, Concerns, and Expectations: *Panellists*

During the final part of the webinar, the panelists received and answered multiple questions raised by the participants. Participants were also encouraged to share their concerns, ideas, and opinions.

The closing note was given by Joanna Doummar.

5. RESULTS AND IMPRESSIONS

Overall, this webinar successfully conveyed the main activities of the project in every aspect. It managed to attract 24 participants (in addition to the eight panelists) from various national, international, public, or private institutions. Those participants represented a diverse group of people that included students, professionals, and stakeholders.

Valuable insights into the knowledge and opinions of a dynamic sample of people interested in the Lebanese water resources were collected through the survey. These data will be analyzed and compared to other surveys conducted on different groups or during the final dissemination workshop planned at the end of the project. This task will be very useful to build an awareness campaign to educate students and professionals about different aspects of this topic.

Some take-home important messages from this webinar:

- Geology and topography play a major role in the water cycle
- Lebanese groundwater resources are highly susceptible to contamination due to the karstic nature of the Lebanese geology and, thus, protection of infiltration zones and continuous monitoring of water quality are necessary
- Climate variability is one of the significant problems endangering water supply throughout the year
- There is a crucial need to set up management plans for water consumption
- Monitoring of snow and water flow data is very important to understand the influence of climate change on water resources and plan accordingly
- Continuously collecting precipitation and flow data from multiple sources and analyzing them allows us to conceptualize the water resources and build an integrated model to produce predictions and forecasts and act on them

This introductory webinar was only a starting point, more steps are needed to fully address this topic and promote sustainability. A few points were mentioned as closing remarks:

- Continue monitoring snow and water data using advanced technologies
- Fully characterize surface geology
- Build a database of snow and water data
- Build and simulate a model that integrates geographic and geologic data to come up with more accurate forecasts of water resources
- Organize awareness campaigns
- Share data and findings with ministries and municipalities that have the decision-making power to implement management plans
- Upscale this project to a national level
- Encourage more research and development in this field