



OCP Policy Center Conference series

Assessment of climate change impact on water, agriculture and energy in Lebanon

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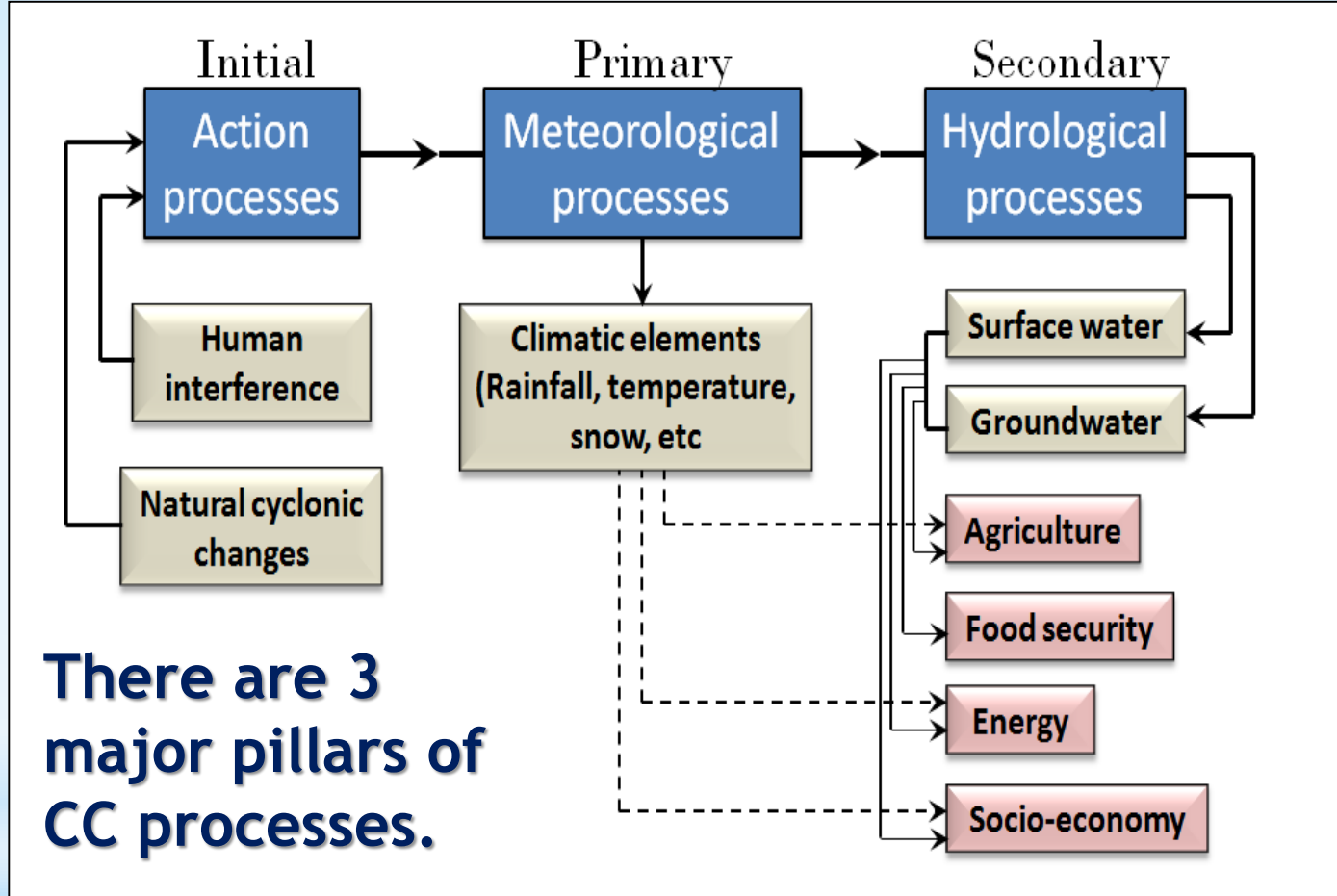
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Introduction

- Similar to many countries worldwide, Lebanon is witnessing substantial changes in the climatic conditions over the last few decades.
- This includes oscillations in rainfall patterns with torrential water-drop regime, as well as the increased temperature rate and variability.
- CC affects major sectors of the economical cycle, emphasizing on Water, Agriculture, Energy and Food
- In this study, three sectors were investigated and their respond to CC influence was deduced, depending of time series records and measures.

Introduction - Cont'd

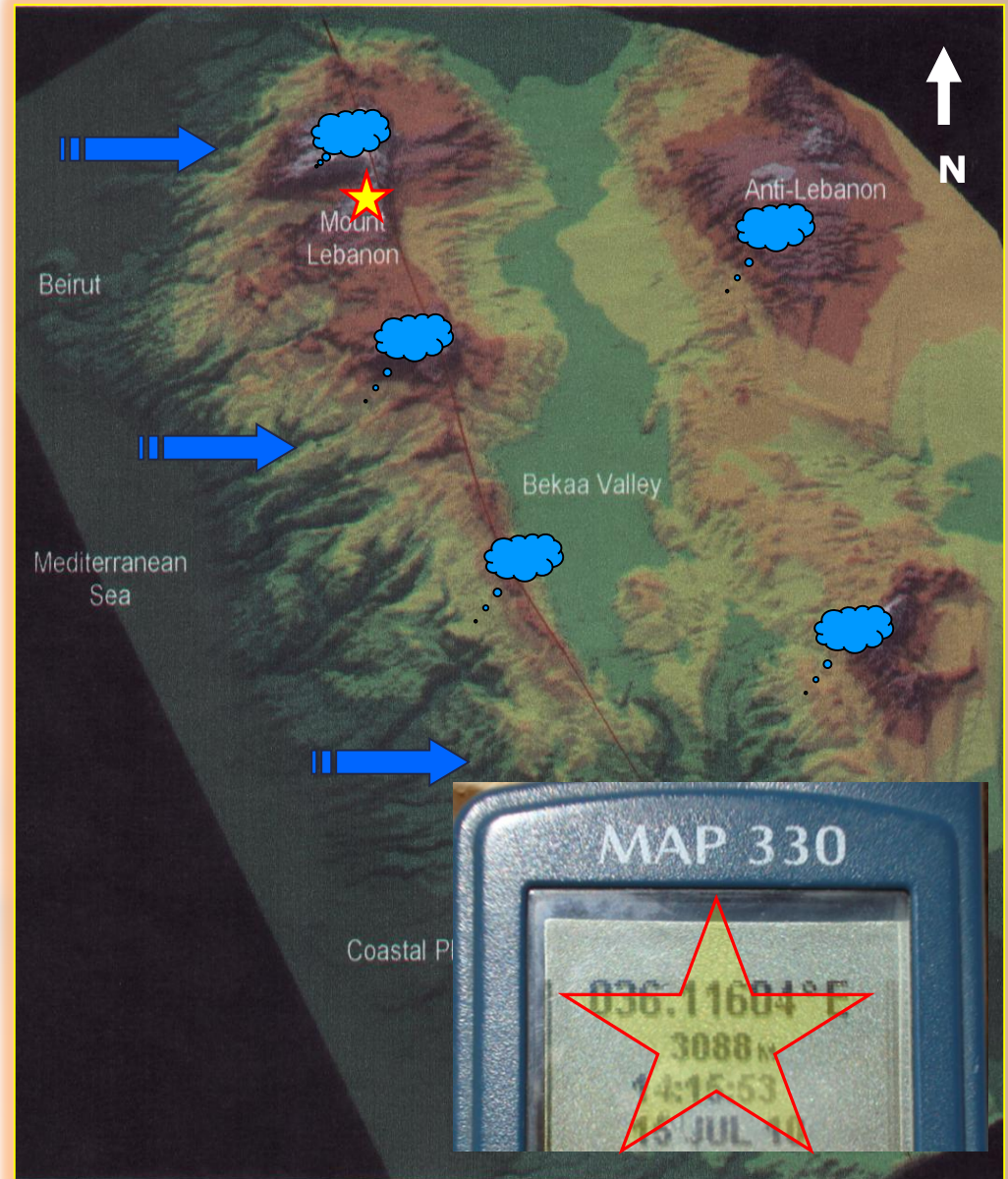
Major Concept



➤ The human interference and the physical changes lead to oscillating meteorological processes that acting mainly on precipitation and temperature. This in turn conflicts the hydrological processes which impacts different sectors as in the subject matter of this study.

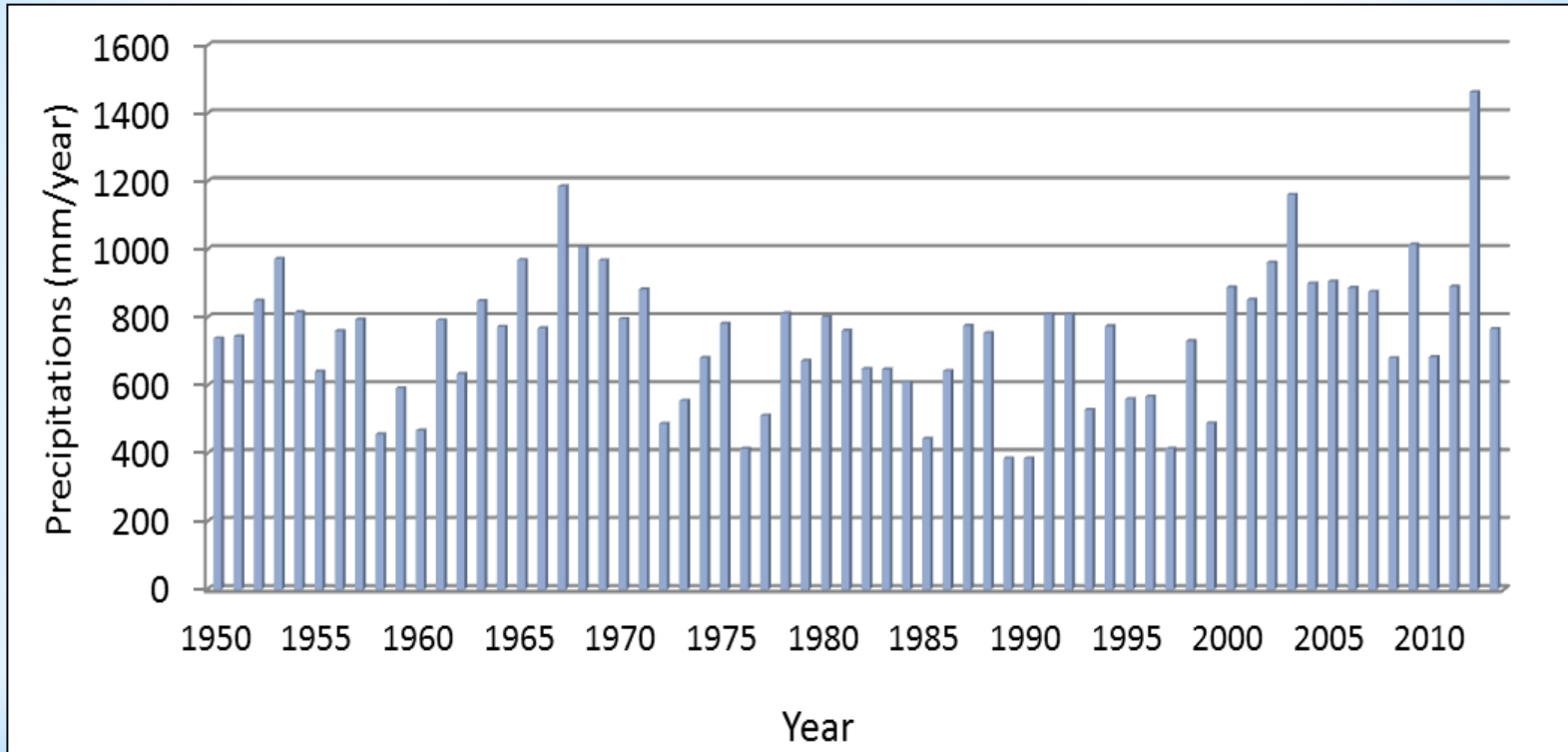
Climate in Lebanon

- *Lebanon is a mountainous region and encompasses the highest elevation in the Middle East.*
- *It works as a climatic barriers that receives cold air masses from the west.*
- *Thus, rainfall ranges between 700 and 1500mm, with snow covering about 2200km²*



Climate in Lebanon - Cont'd

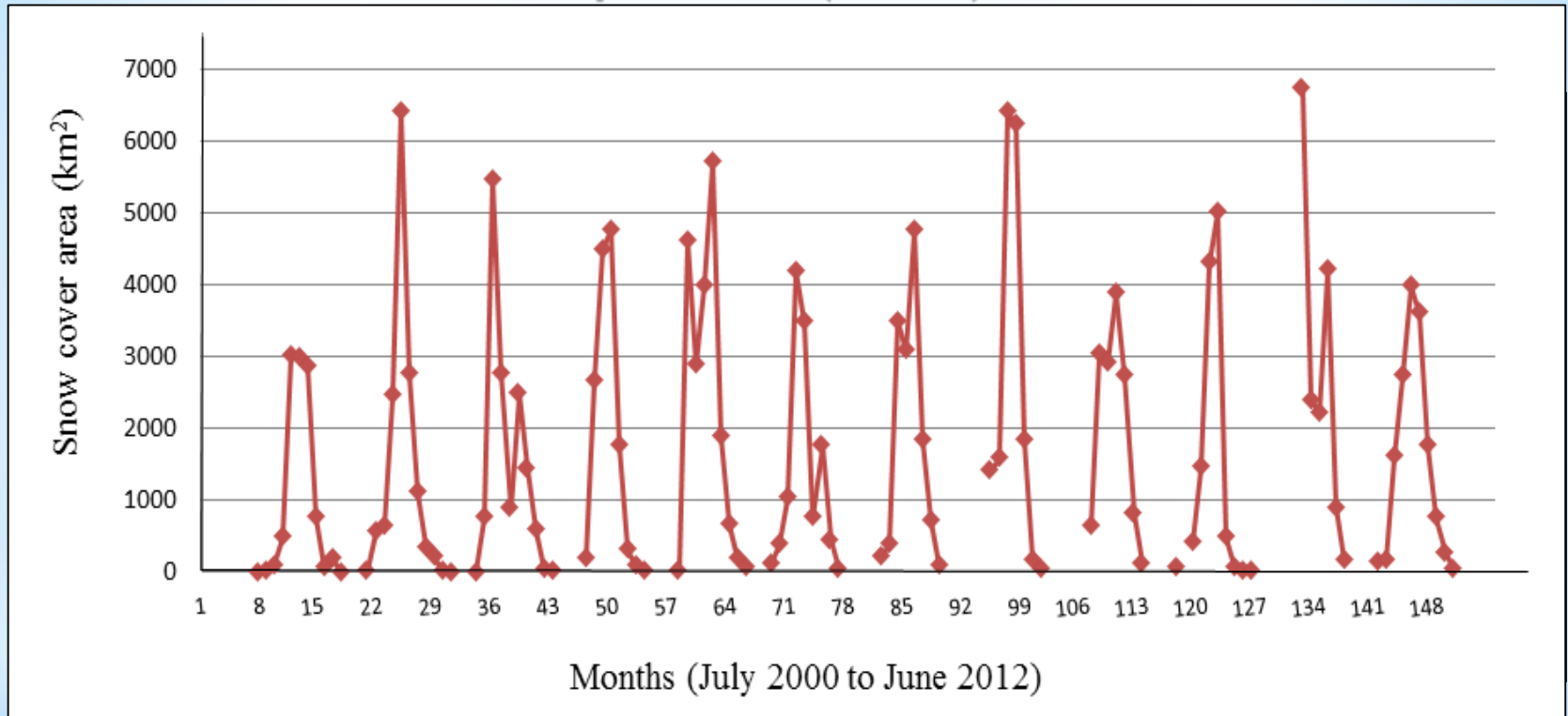
Rainfall Assessment



- Records over 6 decades show small oscillations in rainfall, but no remarkable, just a decline of about 35-40mm.
- However, there is an obvious change in the rainfall patterns towards becoming more torrential than the regular rainfall pattern.

Climate in Lebanon - Cont'd

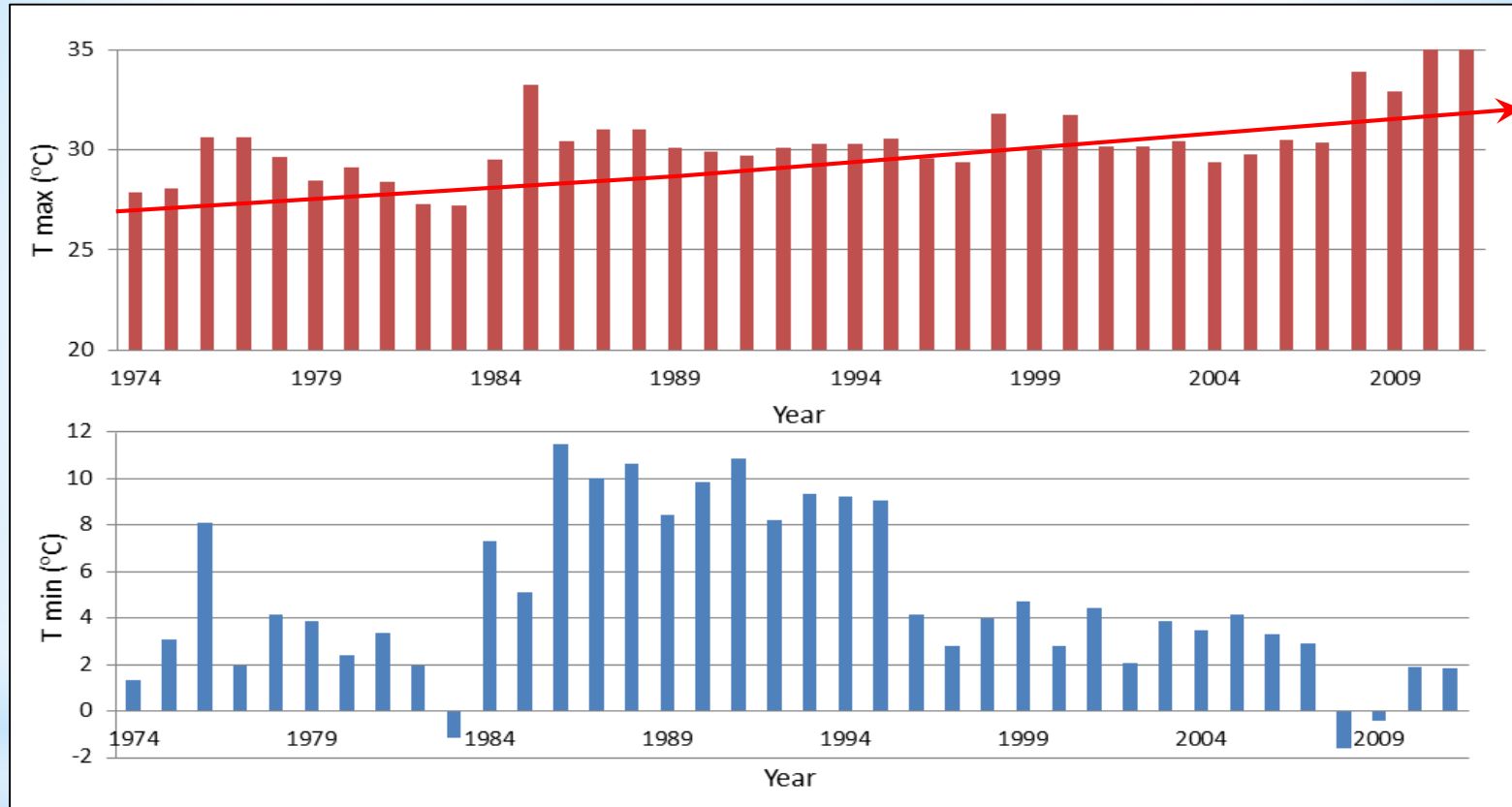
Solid Precipitation (Snow) Assessment



- Snow in Lebanon often covers an area of about 2200-2400km² in average. However, the investigated time series (2000-2013) shows no remarkable change.
- However, the melting rate has been increased lately due to the higher temperature and then due to sunlight radiation.

Climate in Lebanon - Cont'd

Temperature Assessment

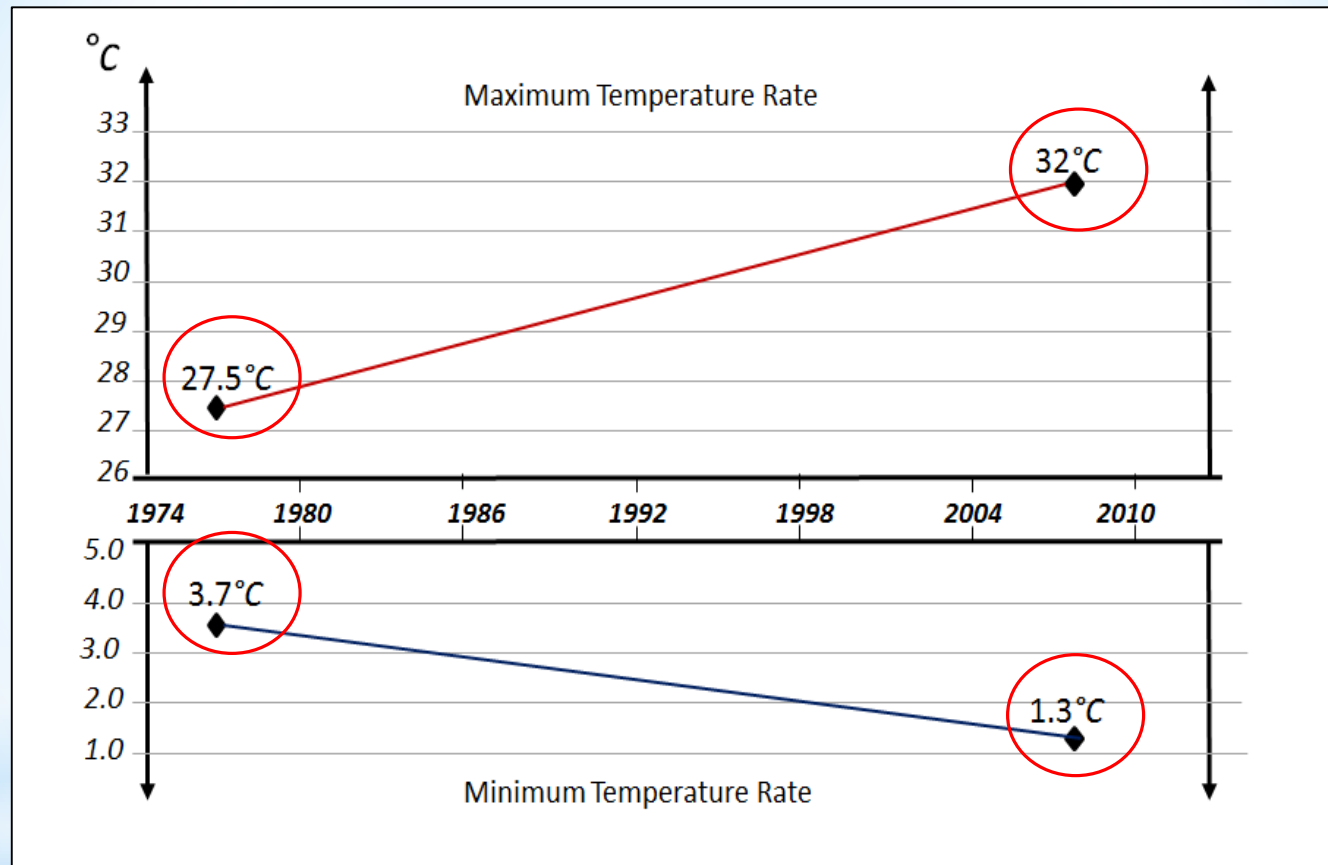


➤ There is increase in the maximum temperature rate over the period (1974-2012), from 27.5°C to 32°C.

➤ Besides, there is also a decrease in the minimum by 0.6°C, over the same time period.

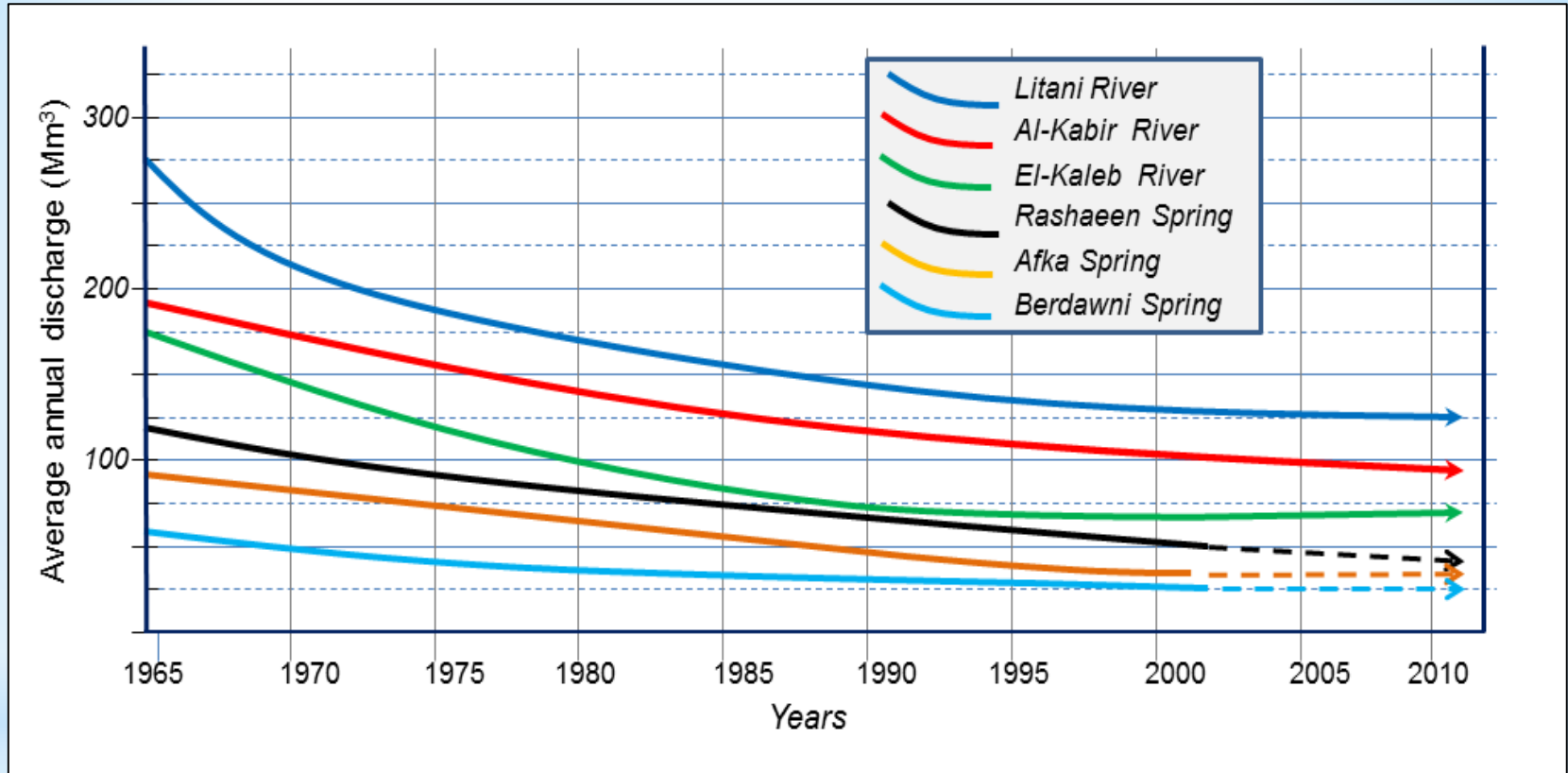
Climate in Lebanon - Cont'd

Temperature Assessment



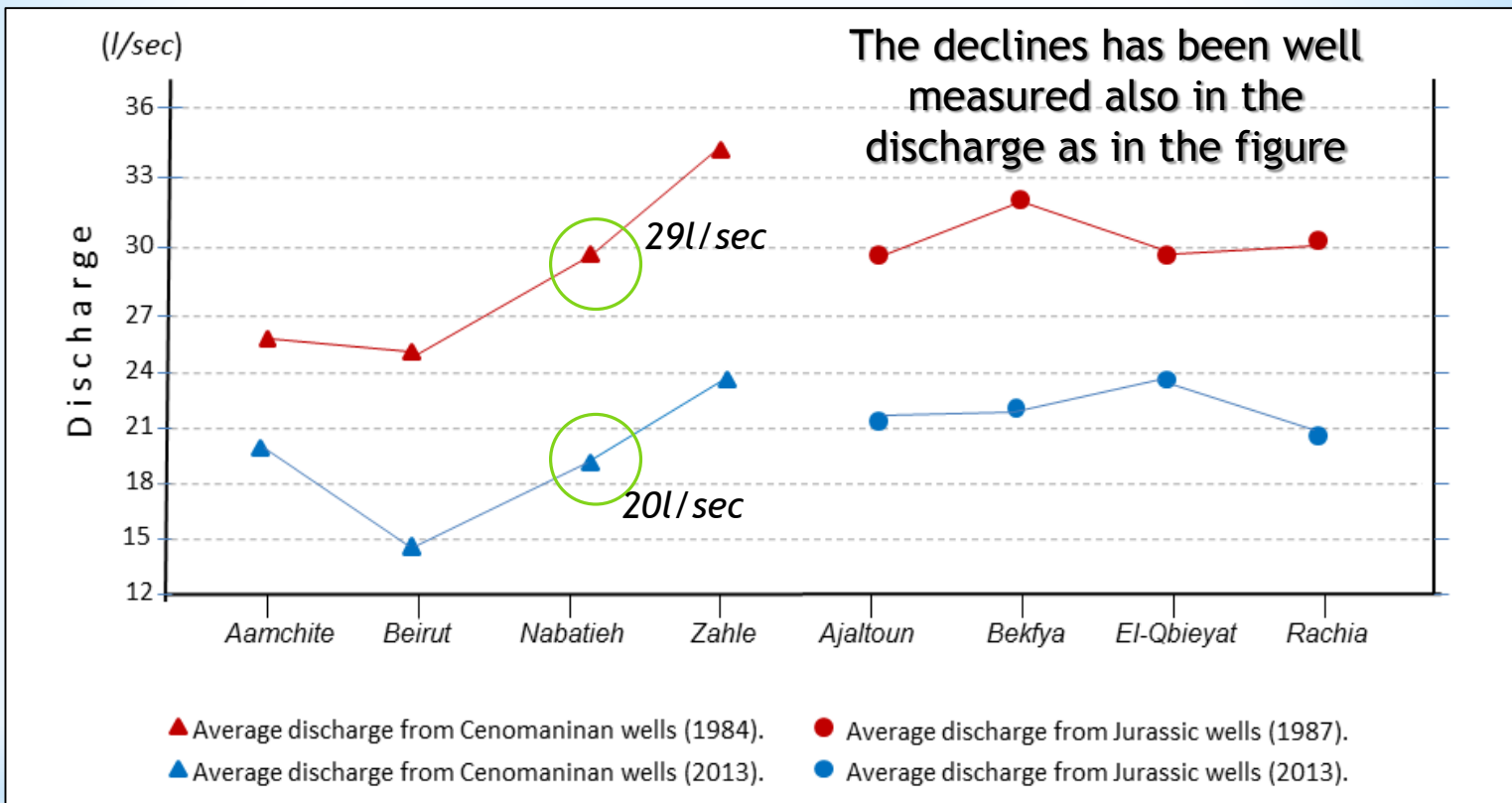
The difference between both temperature rate (maximum and minimum) is widened. This has been indicated in several studies and it points out to the existing changing climate towards desertification (Geenson et al, 2003).

Impact of CC on Rivers and Springs



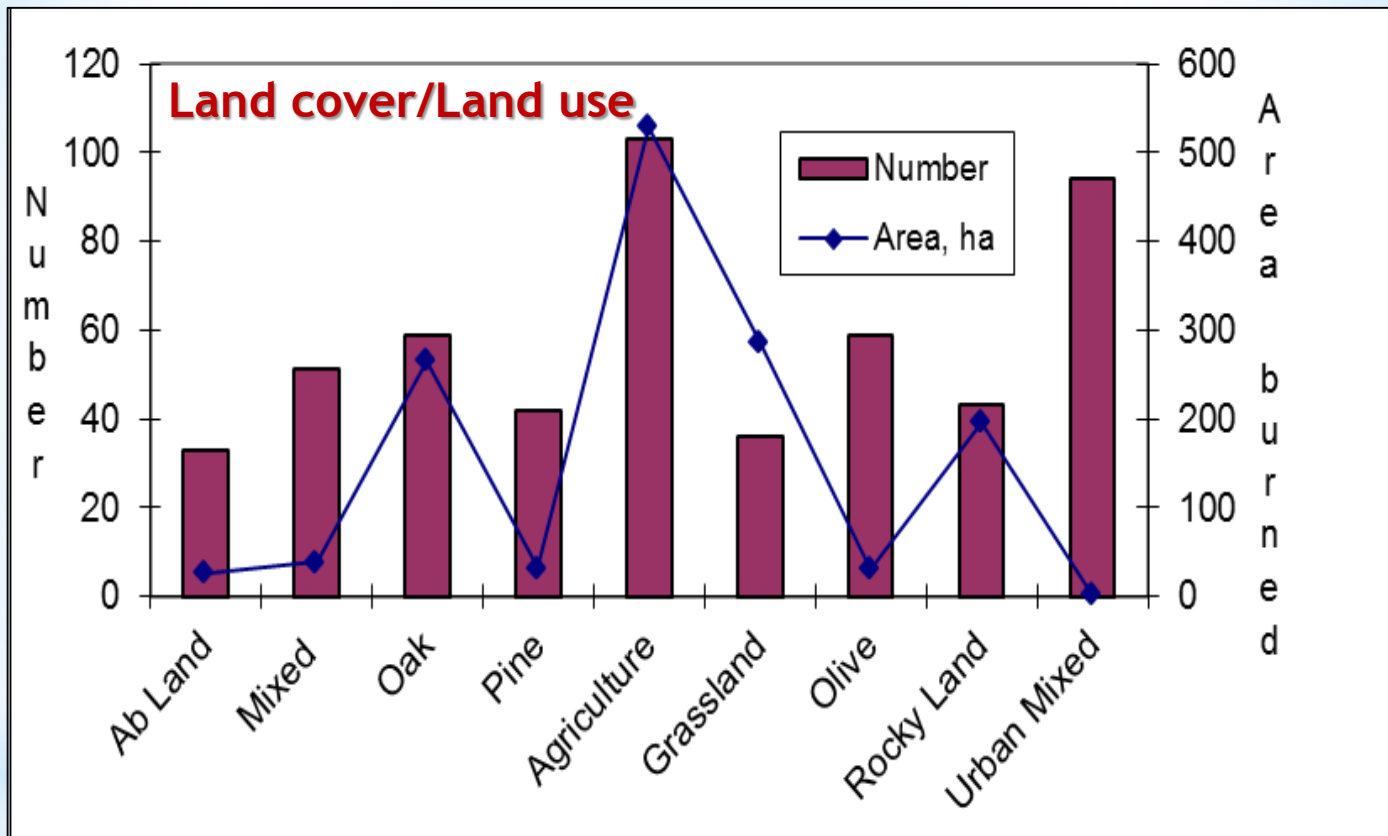
- The assessment has been applied to typical Lebanese rivers and springs over the last 4 decades.
- There is obvious decline in water discharge that sometimes reaches 50% of the normal average.

Impact of CC on Groundwater

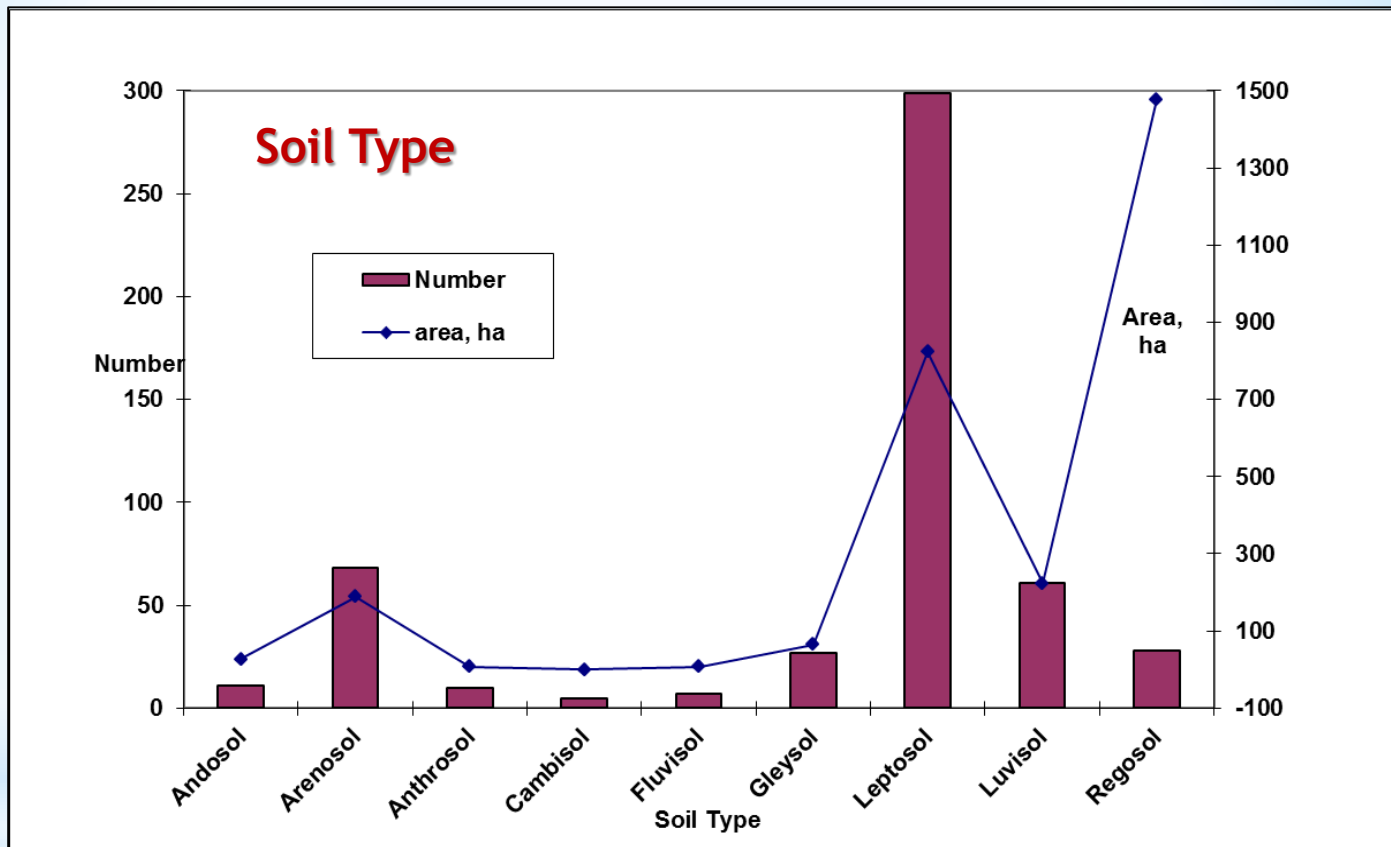


- There are 324 wells have been investigated over about 3 decades. This includes the discharge and water table.
- There is a obvious drawdown estimated at 40-55% and 10-15% in water pumped from the Cenomanian and Jurassic aquifers; respectively.

Impact of CC on Agriculture



Impact of CC on Agriculture



Impact of CC on Energy

- In Lebanon, there are 15 hydropower stations (285 MW) on 7 rivers. However, not all them are functional. This is due to the technical problems and to the low-water level needed to run the AC generators.
- The Qaraaoun Reservoir, the largest artificial lake in Lebanon and most productive hydropower plant (193MW).

◆ By the end of the century, the reduction in precipitation will be higher to 28- 49%, coupled with higher evapotranspiration rates due to higher temperatures, and thus the hydropower generation potential will decrease further (MoE, 2011)

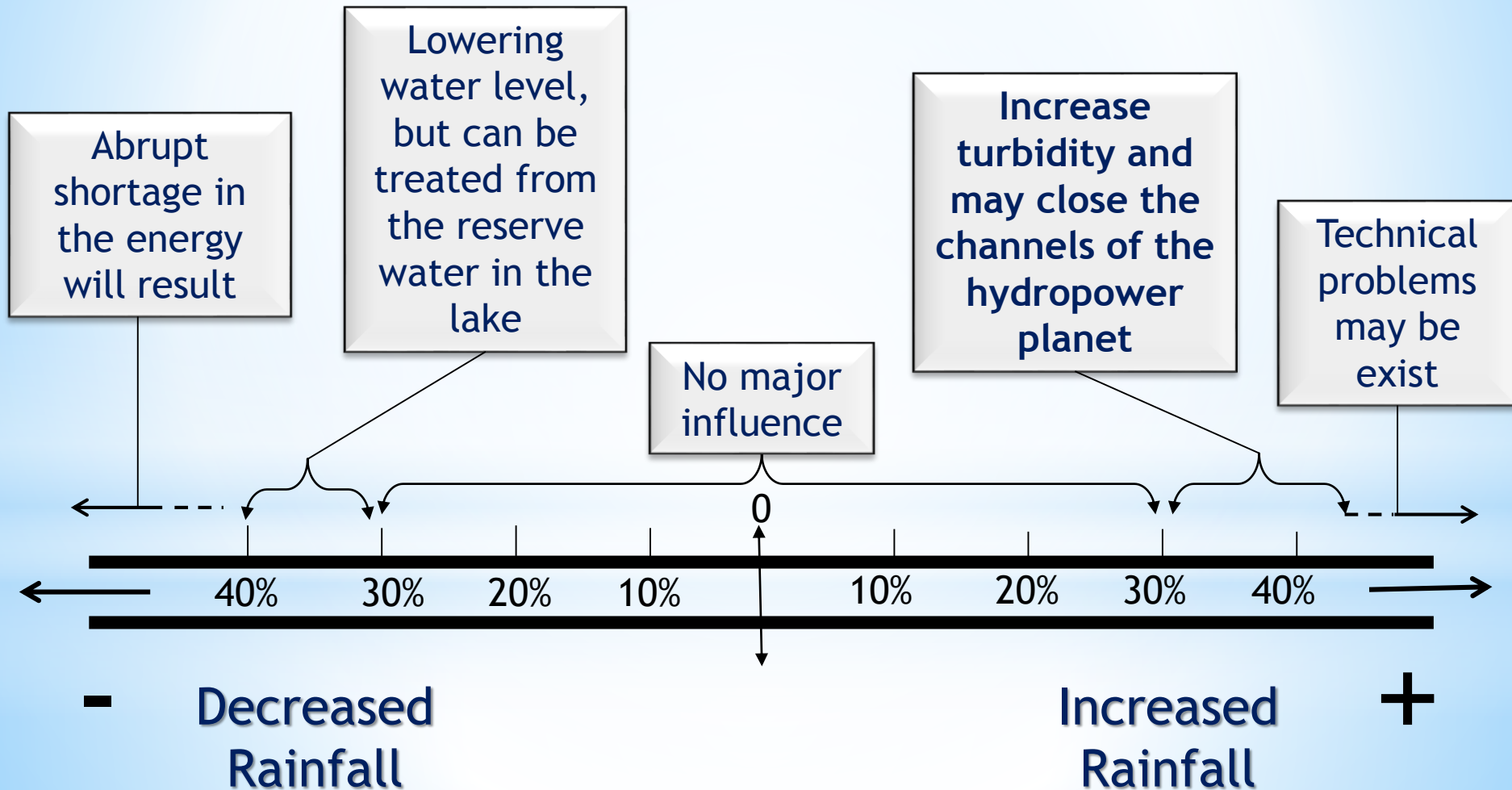


Impact of CC on Energy - Cont'd

- A scenario has been applied to figure out the status of the hydro-power energy released from the Qaraaoun Lake.
- It utilized the *Fisher-Shannon* (FS) statistical method to establish scenarios on the rainfall/stream flow.
- In order to estimate the energy-shortage periods; however, daily gauge datasets were investigated for the three parameters rainfall, stream flow and waterfall from the lake to the generators (R_f , S_f , W_l).

Impact of CC on Energy - Cont'd

► Five-levels scenario were built for Qaraaoun Lake:



Conclusion

1. The exaggeration of **water shortage** and imbalanced water supply/demand will make water as a **competitive commodity** in the next few years in Lebanon.
2. There is a **perturbation of the hydrologic regime** through different processes, including mainly: *lowering infiltration rate, flooding water, water loss to the sea, increased evaporation and transpiration, lowering water discharge in rivers and springs and groundwater; and increased water depth in deep aquifers.*
3. There is exacerbation in **water contamination** in surface and subsurface water sources, and this will be reflected on water-related **agronomical and biological** products.
4. There is obvious **loss of several crops and fruit trees, which are not tolerant to water deficit and drought** conditions.

Conclusion - Cont'd

5. The **raising the level of contamination in soil and agriculture products** due to excessive use of fertilized and nitrates. This will be followed by increased costs.
6. There is a mapping of **new demographic reallocation** between different regions, and thus resulting substantial changes in the socio-economic status in the entire country.
7. The number of **non-functional hydropower stations** has been increased due to the lowering water level in rivers that feed the AC generators.
8. There is an **increase in energy cost** due to the higher demand of energy as a result of population growth and lack of local energy resources.
9. The need for **adaptation policy.**

Thanks for your attention