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Snow Research Activities

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Workshop Snow and Flow Webinar, 3 November 2020

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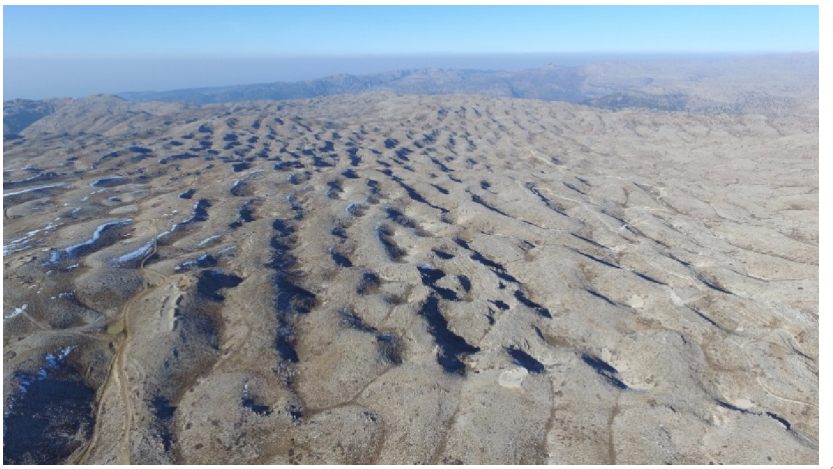
Geomorphology

High lands of Mount Lebanon

Altitudes: between 1700 and 3000m;
Geology: Cénomanian (C4);
Characterized by karstic shapes like dolines (sinkholes) and undulations



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Geomorphology

Snow = water
Snow Volume is very important to have an accurate estimation for SWE

These depressions trap the snow and its meltwater.
General orientation of undulations favors cornices formation due to prevailing winds from south-west

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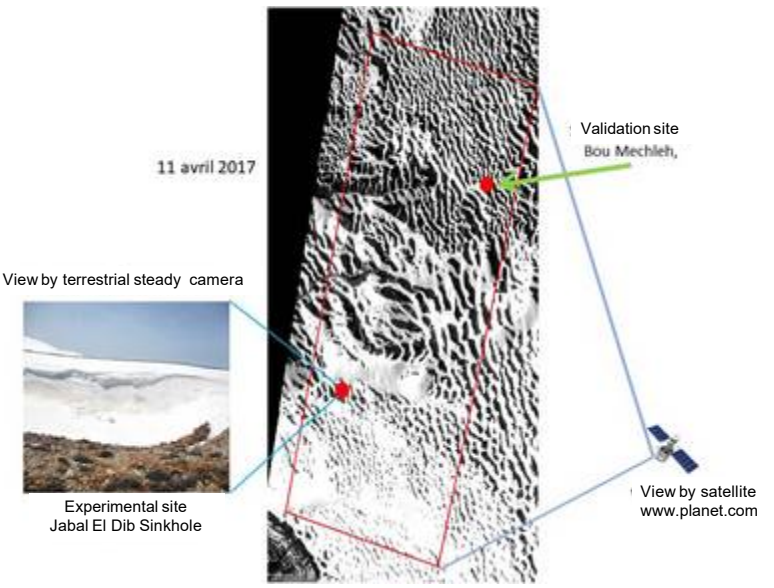
Geomorphology



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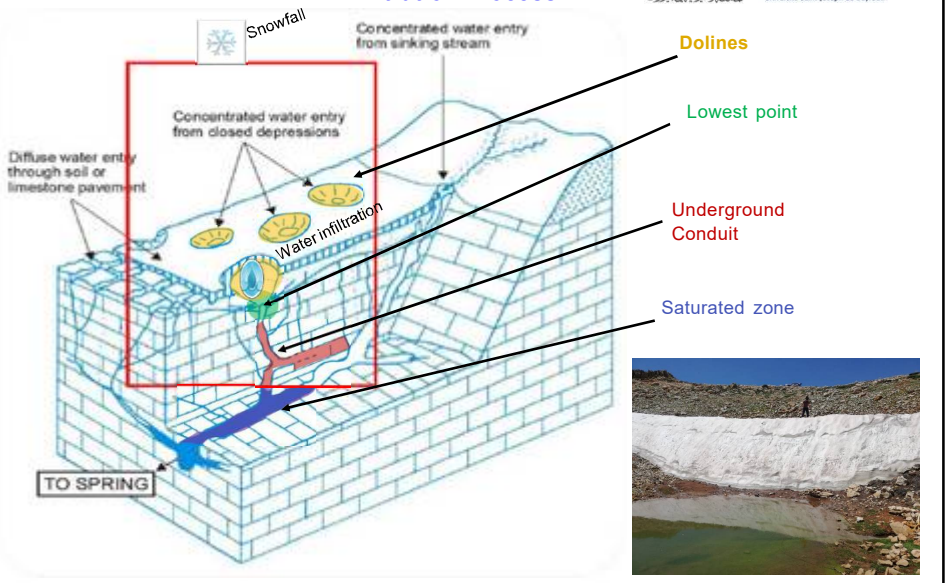
Geomorphology
Infiltration Process



https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-irish-karst/karst-landforms/Pages/Enclosed-depressions.aspx

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Geomorphology

Enhancement of the DEM shows a multitude of dolines that act as containers and also as strainers since the meltwater that cannot flow out of the depressions is forced to infiltrate.

The very large number of dolines make from the summits of Lebanon a huge water tower. For that reason those areas have to be protected from all kind of degradations.

Other interests:

- Help to find dolines alignements;

- and to map faults and fractures.

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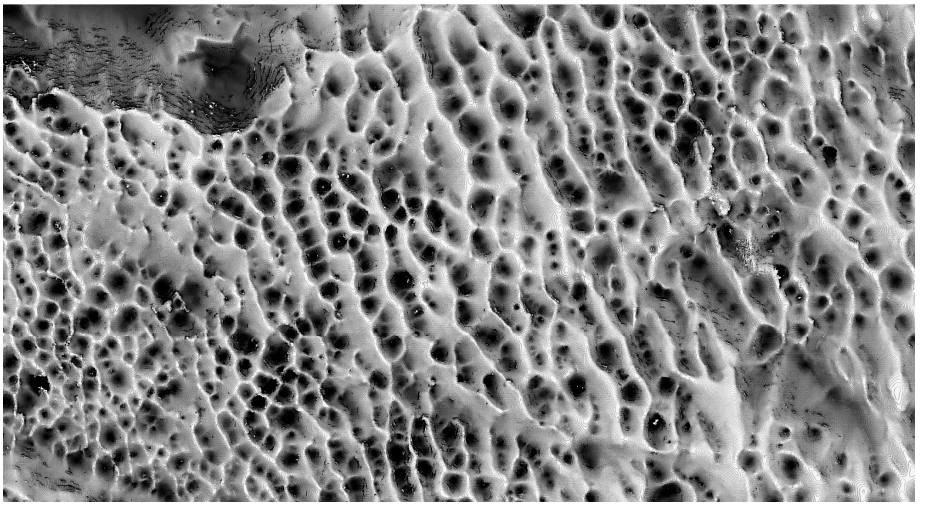
Geomorphology



Map big and micro watersheds;

Find the lowest points of each doline which could be the most important infiltration point;

Use those points to map the dip of the floor

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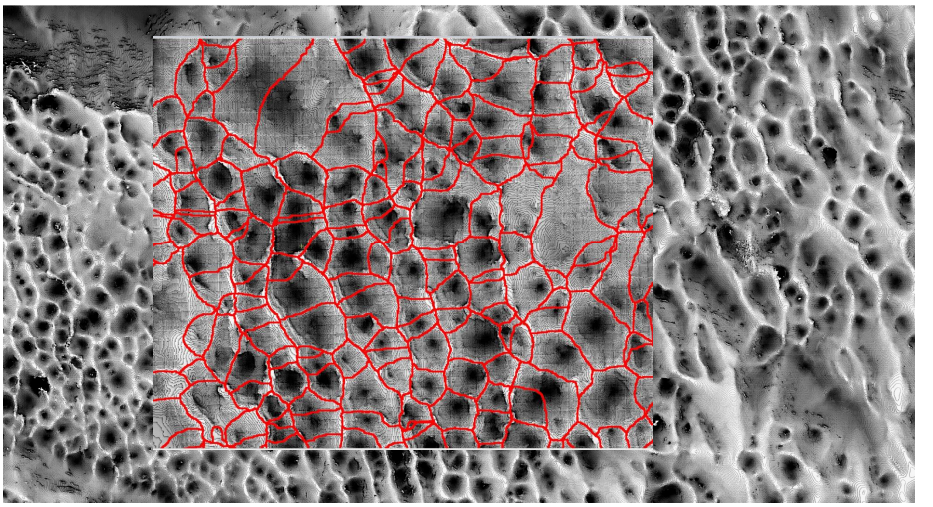
Geomorphology



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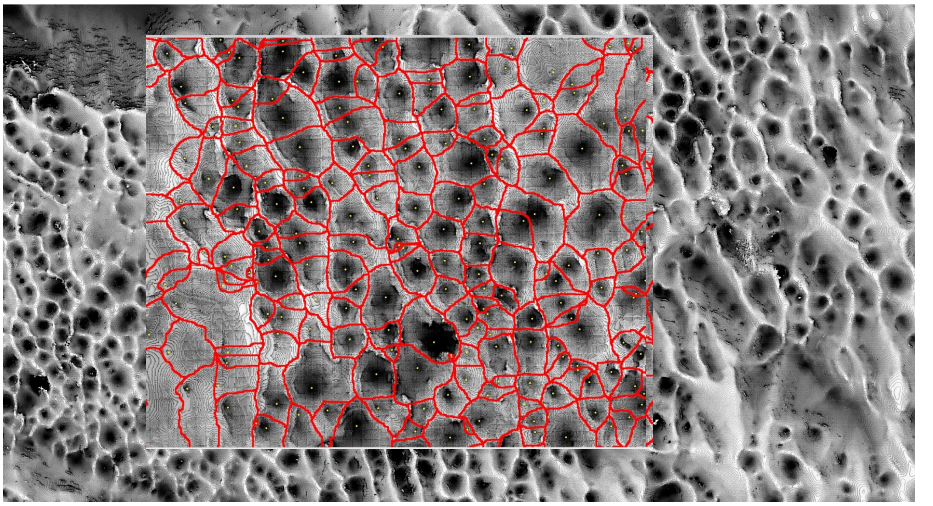
Geomorphology



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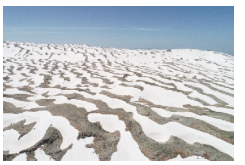
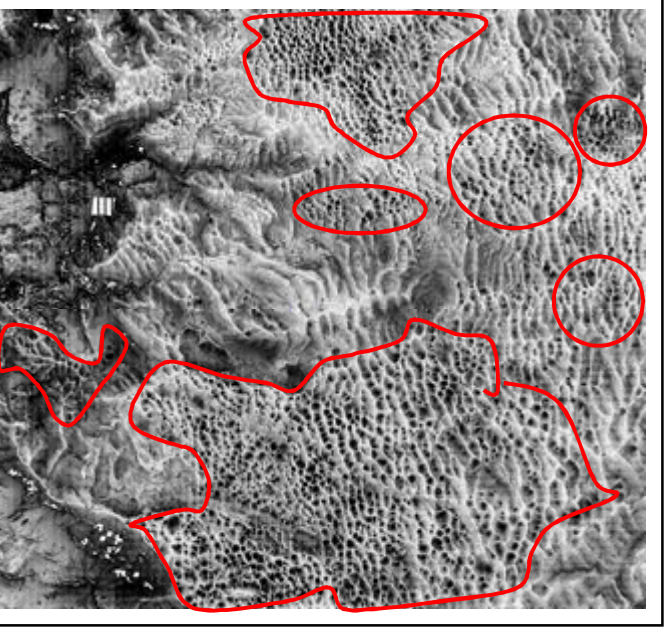
Geomorphology

Dolines Concentration





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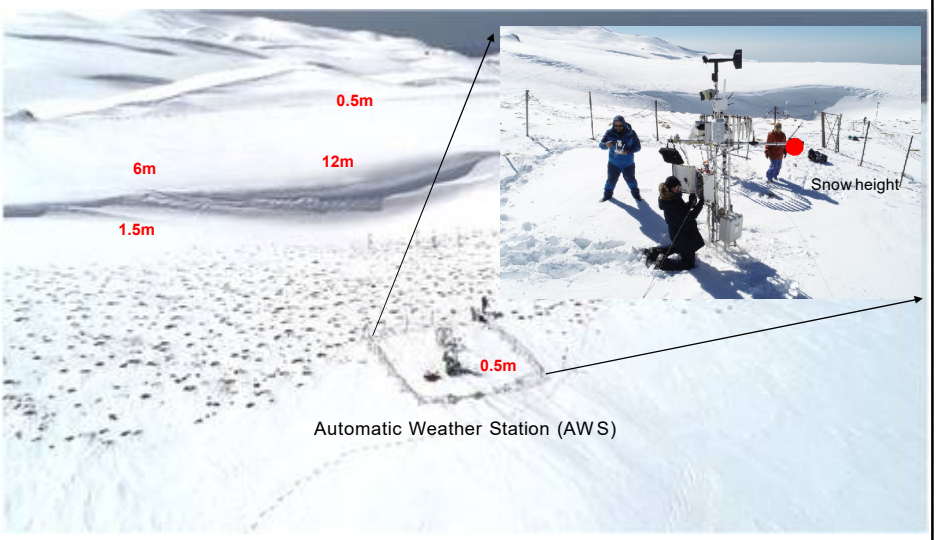
Snow Observatory

Weakness of AWS for snow height mapping in high plateau



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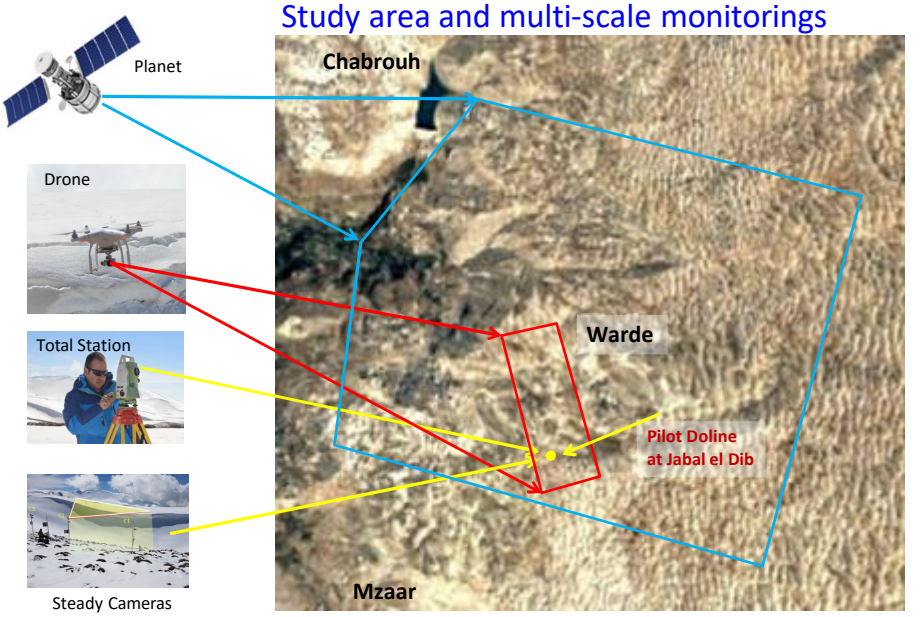
Snow Observatory

Study area and multi-scale monitorings



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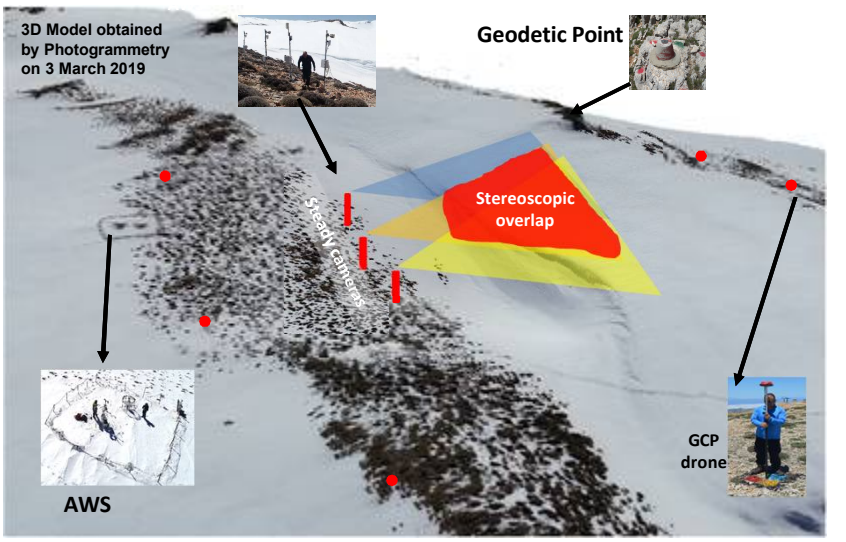
Snow Observatory

Instrumentation of the observatory at the pilot doline



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Snow Observatory

Automatic daily snowmelt monitoring using steady cameras

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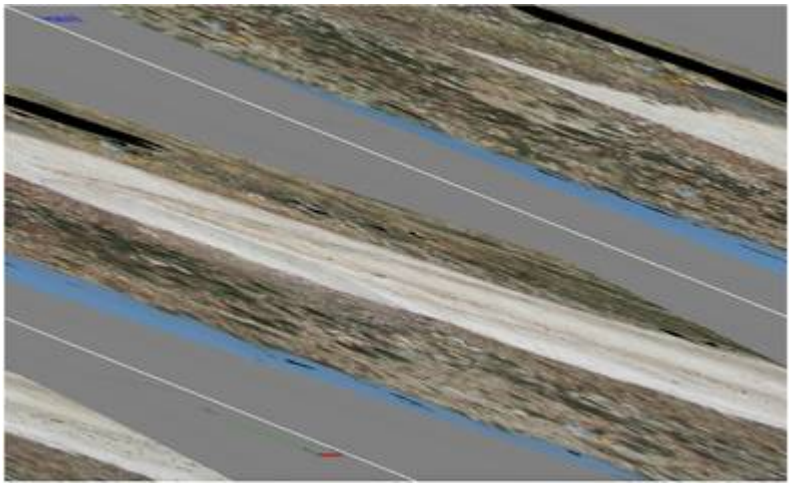
Snow Observatory

Obtained 3d Volume for the automatic daily observation



Ref: Abou Chakra, C, Gascoin S., Somma, J., Drapeau L. & Fanise Pascal (2019). "Monitoring the snowpack volume in a sinkhole on Mount Lebanon using time lapse photogrammetry". Sensors 19(18):3890. DOI: 10.3390/s19183890

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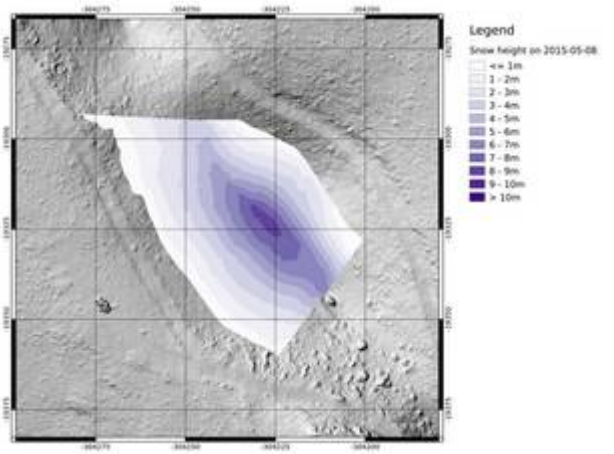
Snow Observatory

Time-lapse photogrammetry toward automatic snow daily snow volume estimation on the pilot doline at Jabal El Dib.



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Snow Observatory

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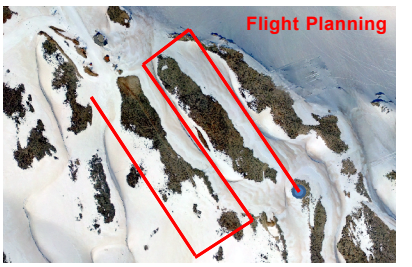
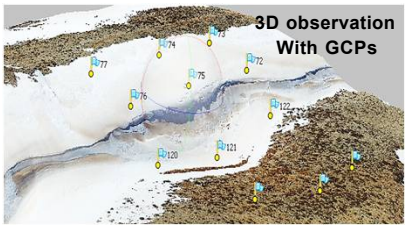
Snowmelt monitoring using Drone

28 March 2017
to
11 July 2017





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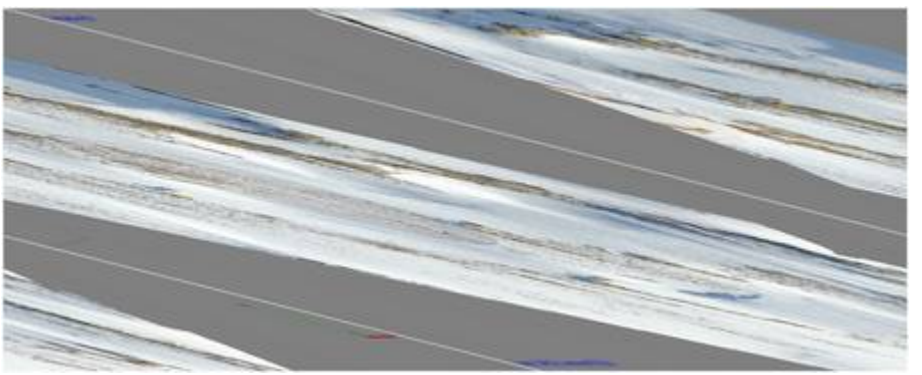
Obtained 3d Volume using drone observation



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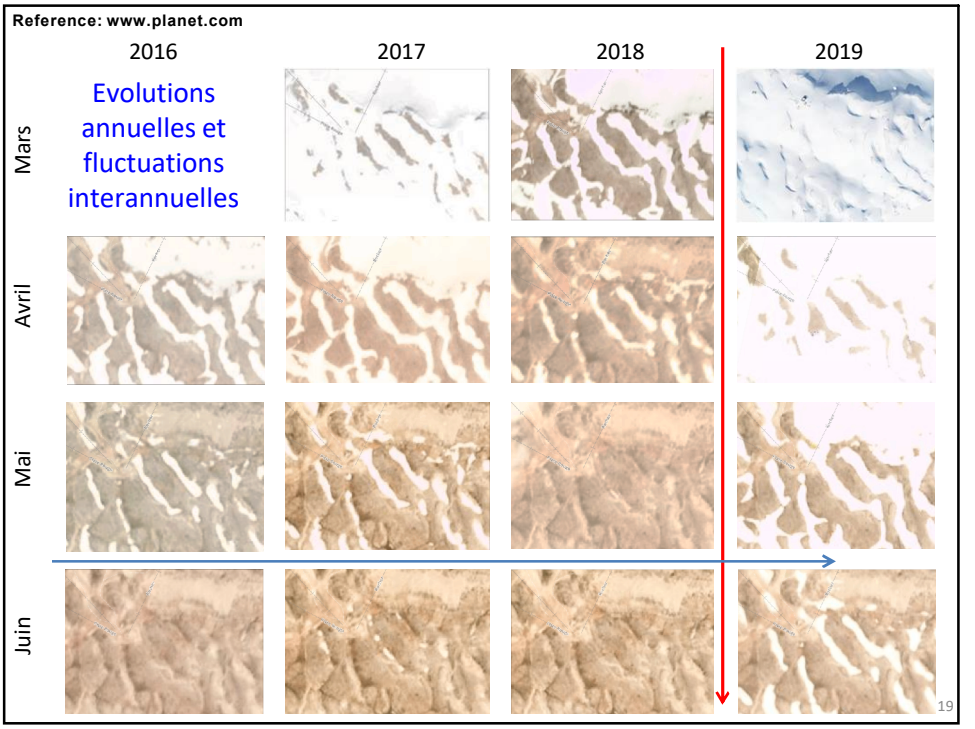
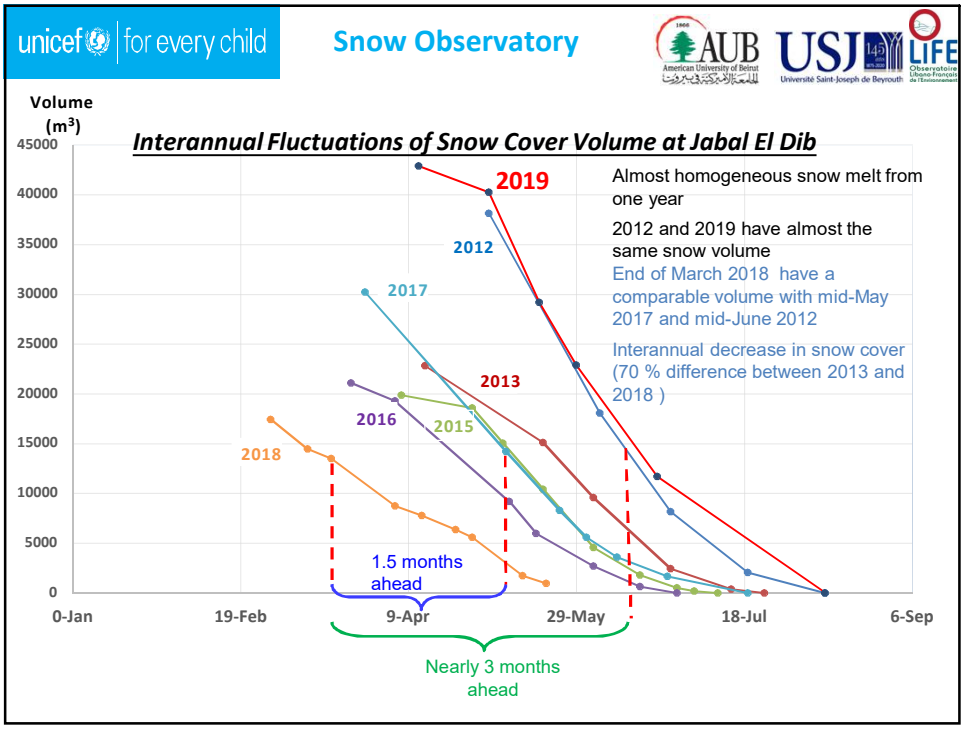

Reference: www.planet.com
2016
2017
2018
2019
Evolutions annuelles et fluctuations interannuelles
Mars
Avril
Mai
Juin
19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AUB
USJ
LIFE
Volume (m³)
Interannual Fluctuations of Snow Cover Volume at Jabal El Dib
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0-Jan
19-Feb
9-Apr
29-May
18-Jul
6-Sep
2019
2012
2017
2013
2016
2015
2018
Almost homogeneous snow melt from one year
2012 and 2019 have almost the same snow volume
End of March 2018 have a comparable volume with mid-May 2017 and mid-June 2012
Interannual decrease in snow cover (70 % difference between 2013 and 2018)
1.5 months ahead
Nearly 3 months ahead

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Snow Observatory

Prediction of total snowmelt date

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Snow Observatory

Prediction of total snowmelt date

(Jabal El Dib in 2018)


28 Feb 2018


18 March 2018


06 April 2018


18 April 2018


24 April 2018


29 April 2018


14 May 2018


20 May 2018

Date of prediction

Uncertainty of prediction = ± 1 week


15 June 2018

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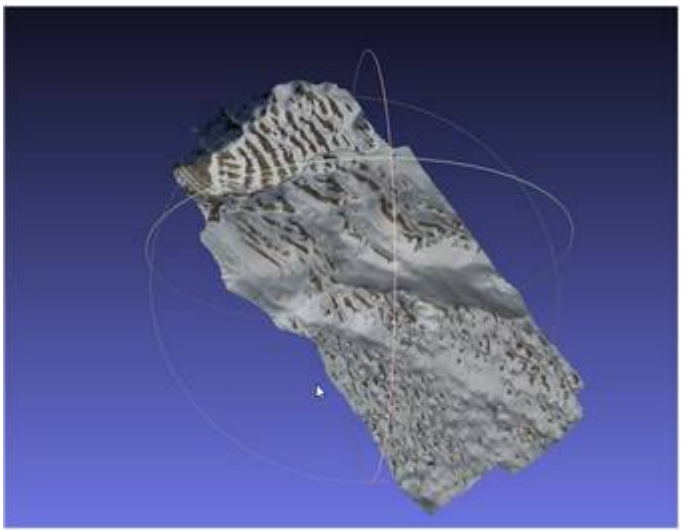
Future Expectations

3D Animation of the observed area on 3 March 2020

Observed area: 3 km * 1 km



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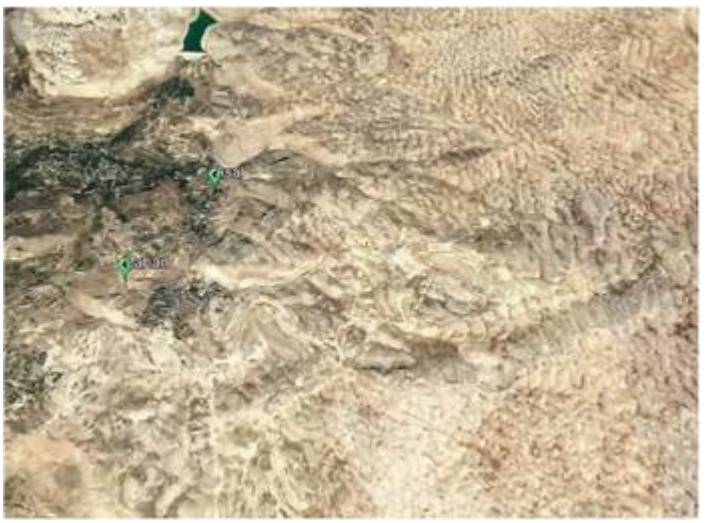
Future Expectations

Time-lapse of the observed area during 2020 snow season

Observed area: 3 km * 1 km



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Expected Chalenges

To confirm that the evaluated snow volume on a large surface area have the same melting tendency as the pilot observation site;

Verify if it is possible to estimate the snow volume through the 2D satellite images having a free access and high temporal and spatial resolutions;

To have a reliable predictive approach on the date of the total melting of large snowy area;

In our case, the snow being up-stream on the hydrological cycle, it seems important to monitor as part of an observatory due to the impact that the monitoring can have on the understanding of the hydrology of the area.

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