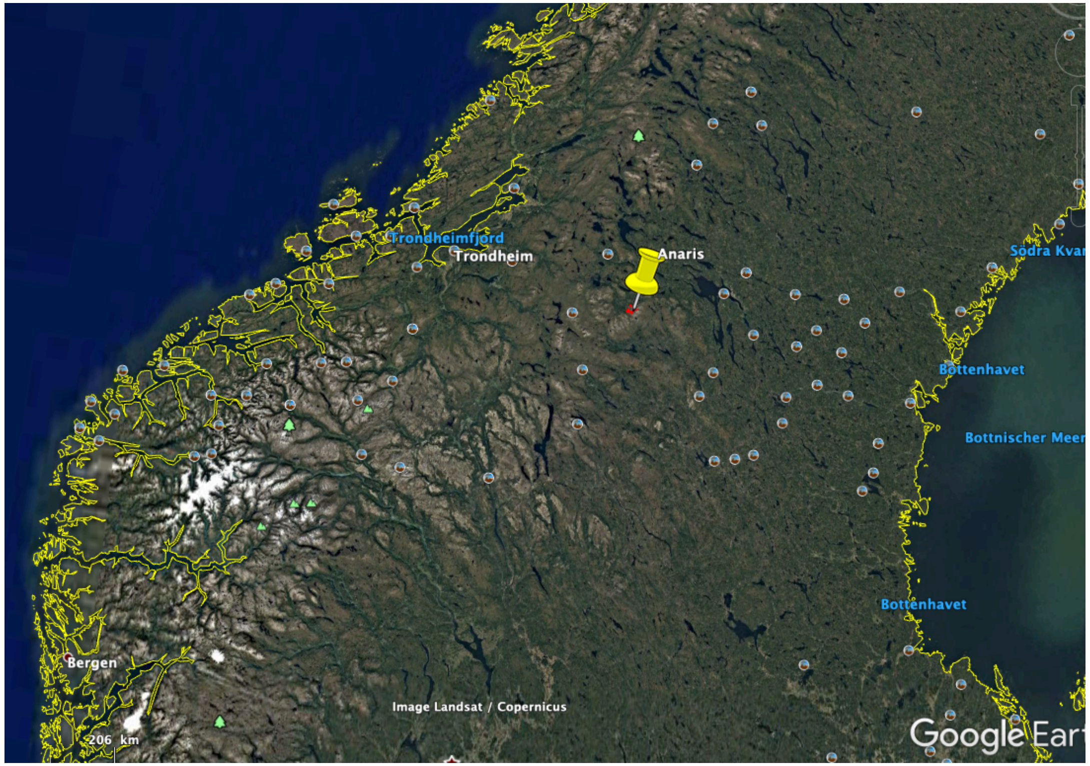
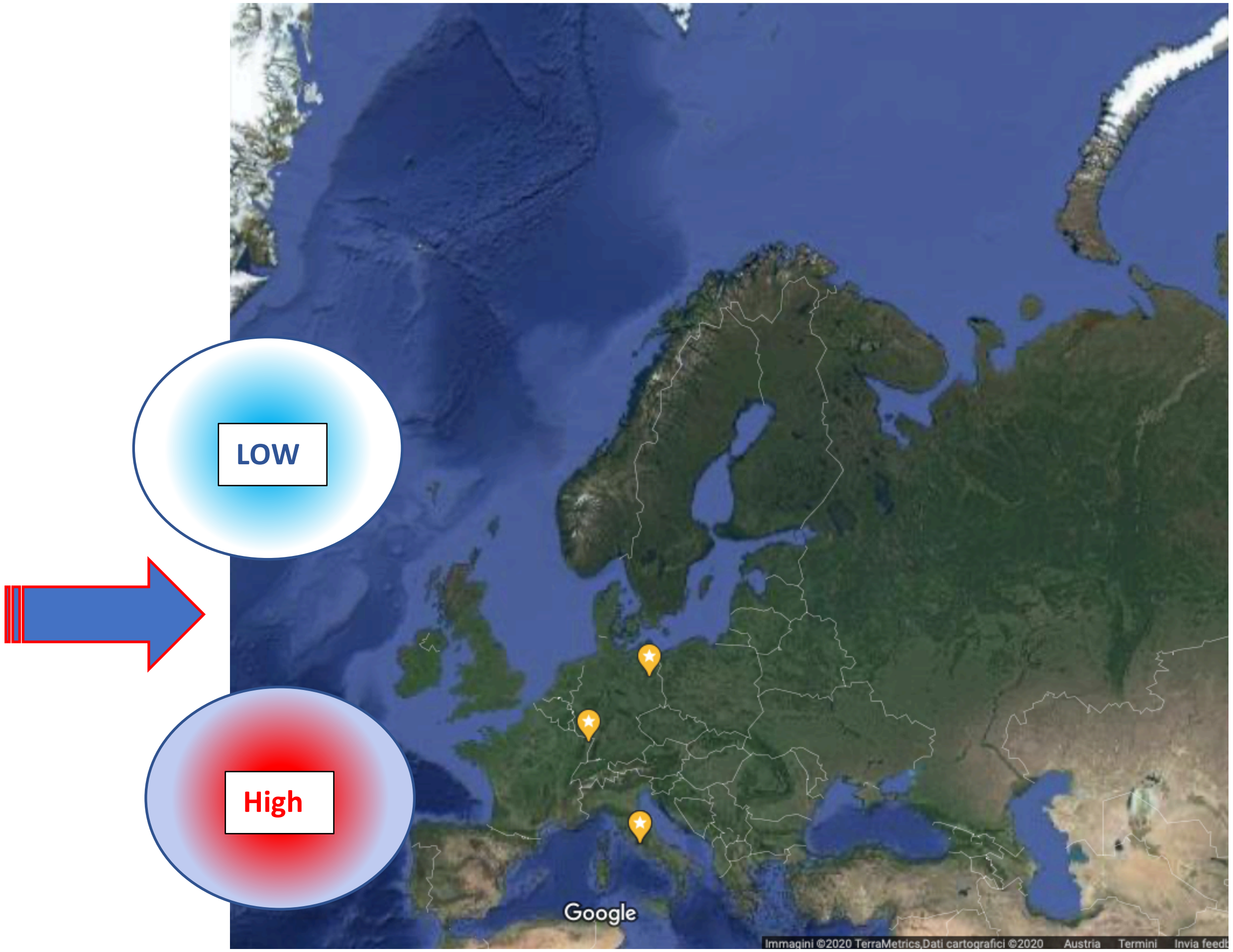
Anaris- Accident 1978

1. TOPOGRAPHY

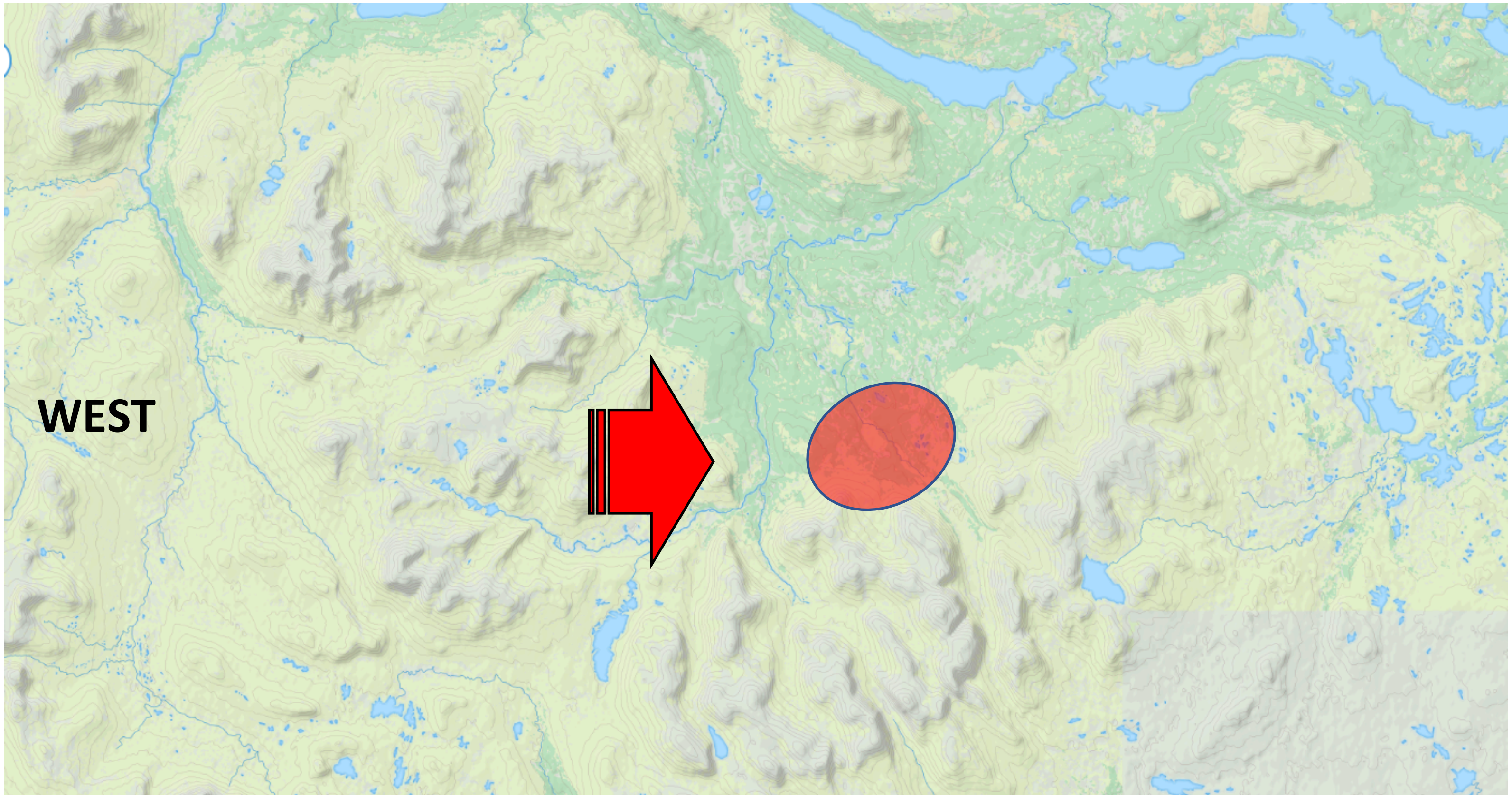


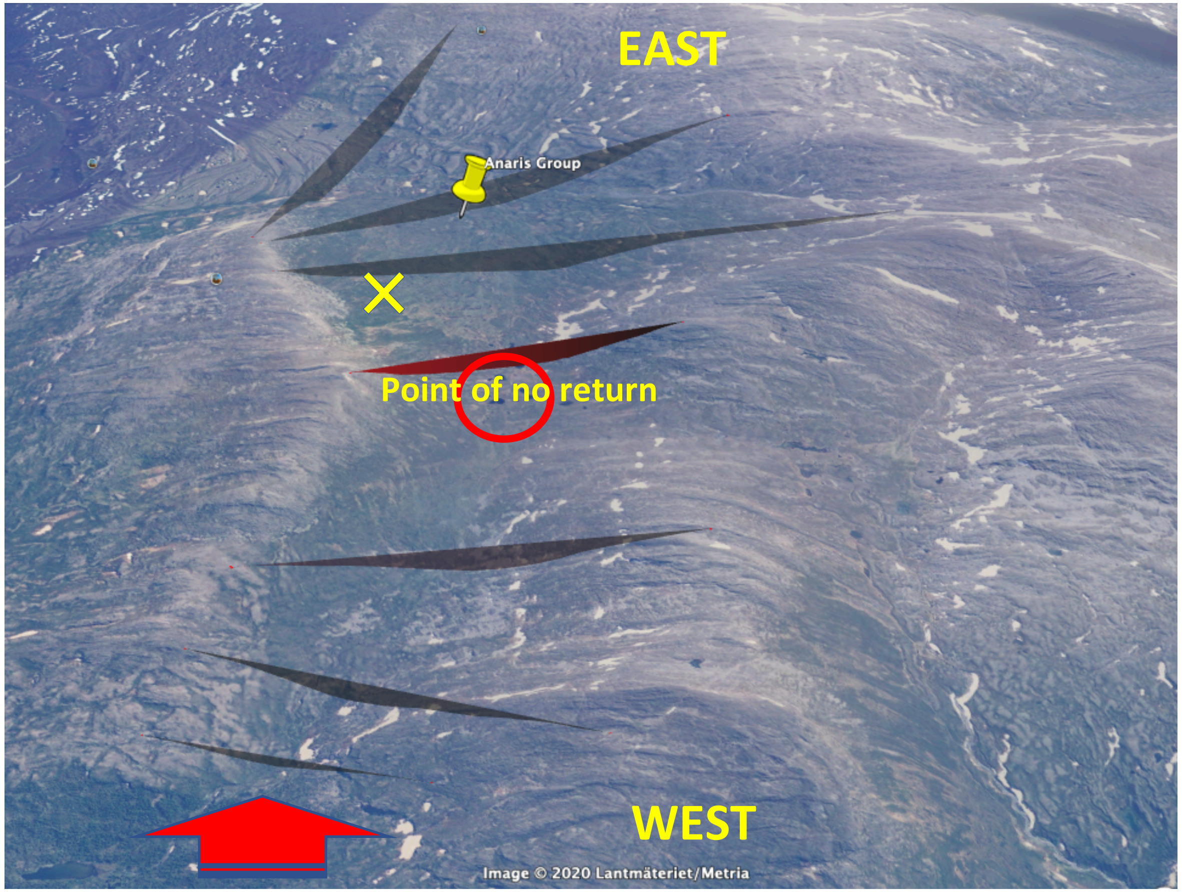
There are 2 different general weather conditions that can lead to disastrous conditions in the Anaris mountains.

1. Low-Pressure-Centre in the North and High-Pressure-Centre in the South.

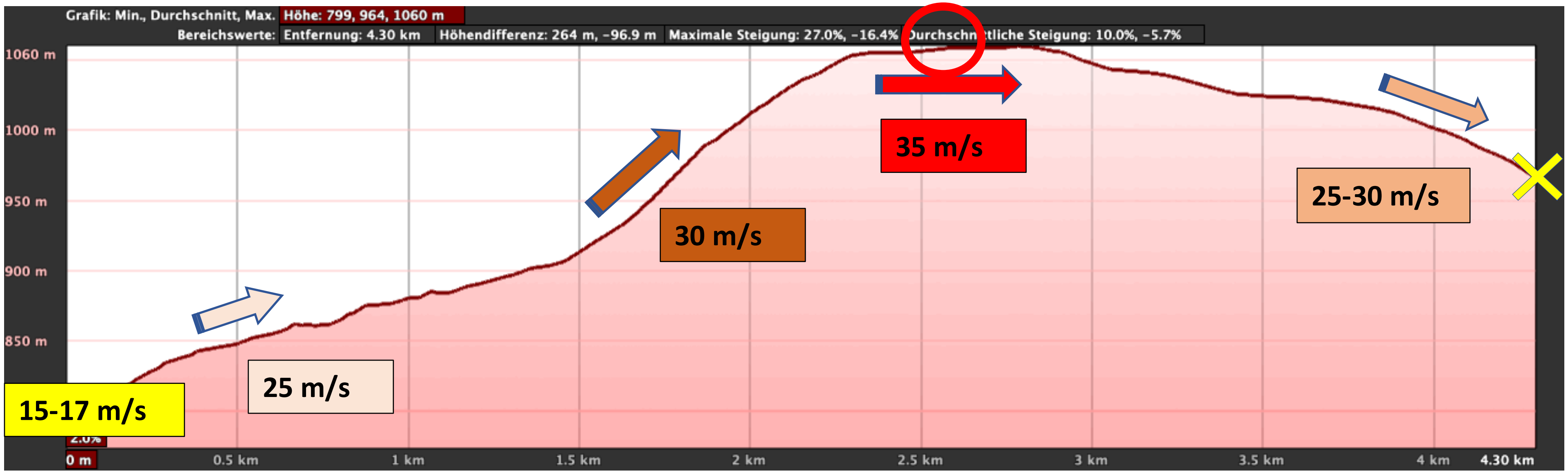


The effect results in a wind blowing from West.

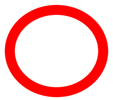

WEST



The illustration shows how the western part of the valley is reduced in width - the wind speed will therefore increase (Bernoulli-Effect). Because of the increasing wind speed at high altitude, a storm is developed. At the highest point of the pass, winds up to 35 m/s are reached. This is also the point of no return – that is, returning is impossible since walking against the wind or escaping the front usually ends deadly. Walking back is too far and it is easy to lose orientation at night.

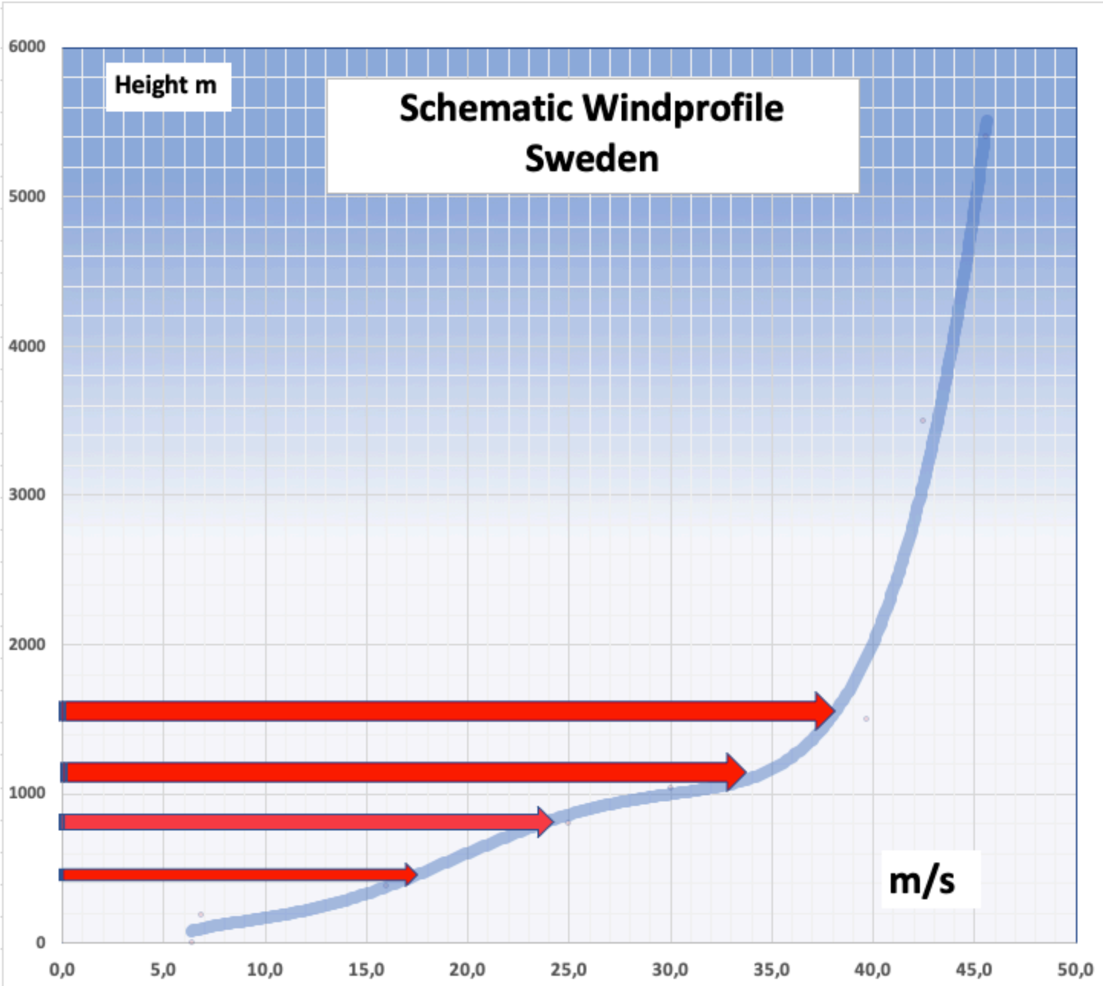


Lönndörrsstugorna (the group's starting position)



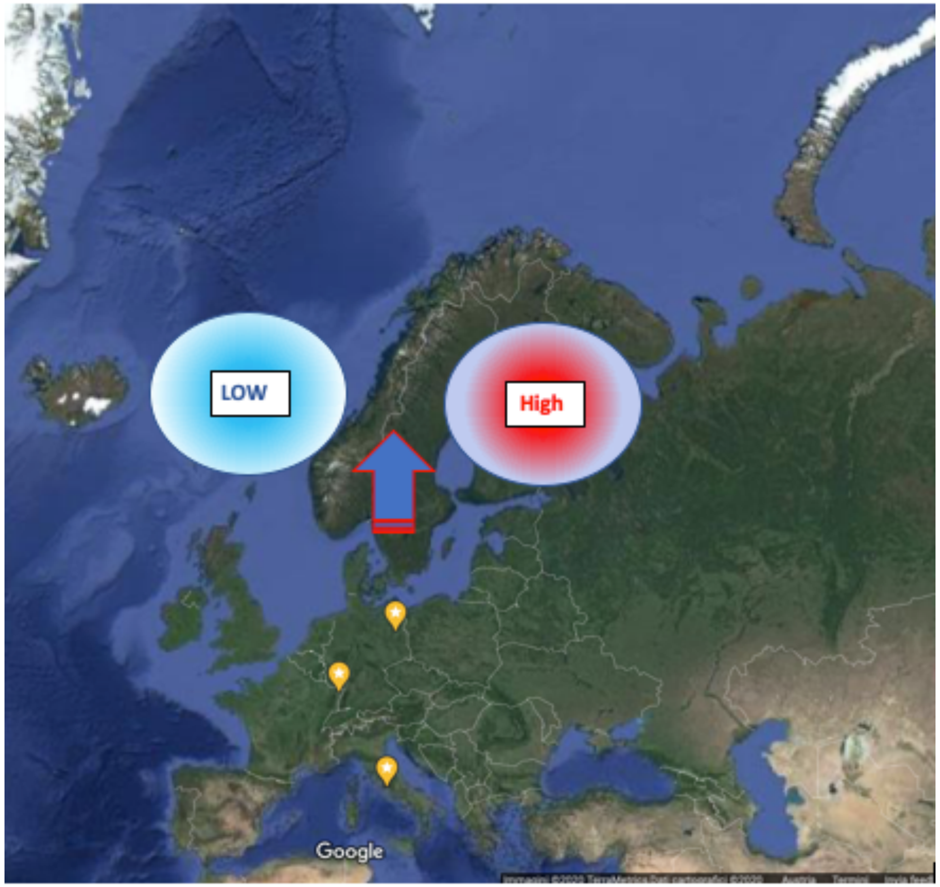
"Point of no Return!"

Start Position

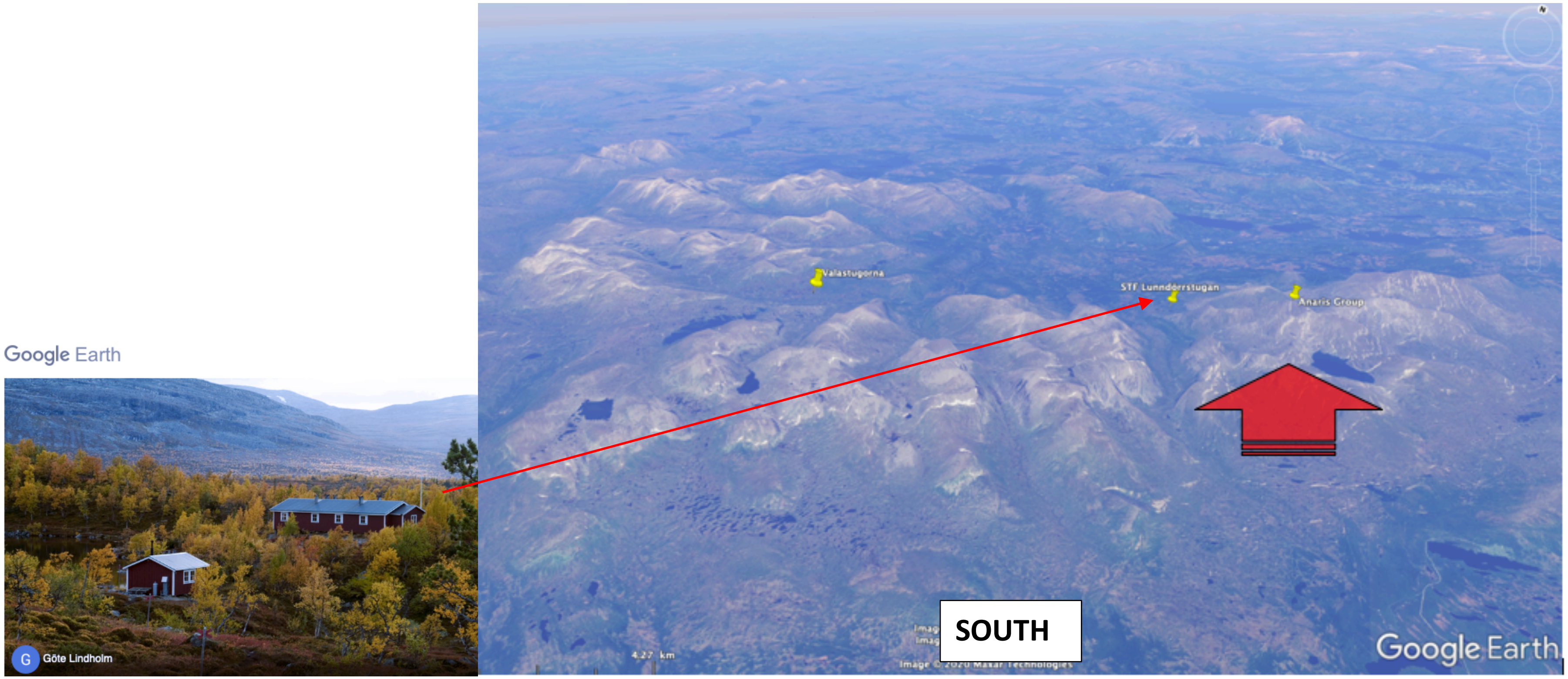


The wind speed increases with height. This effect is called "Gradient-Factor". The "Bernoulli-Effect" produces the "Bernoulli-Factor" (see below).

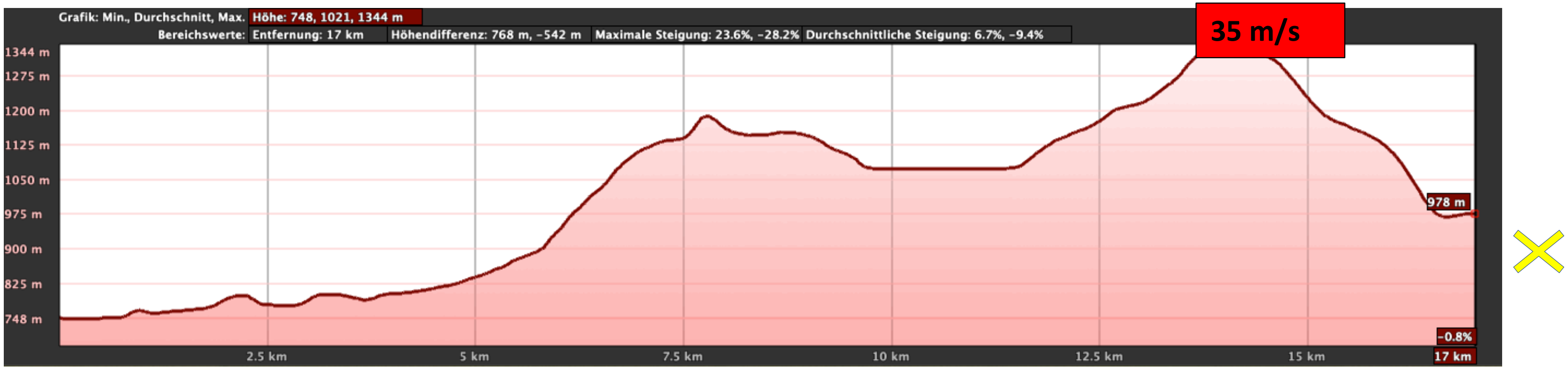
2. Low-Pressure-Centre in the West and a High-Pressure-Centre in the East (February 1978)



The conditions shown results in a wind direction from South.

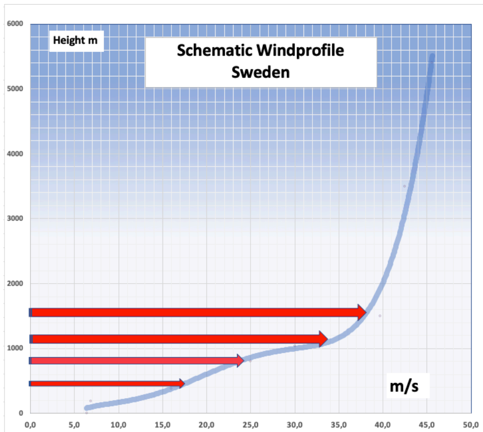


The group's starting position (Lönndörrsstugorna).

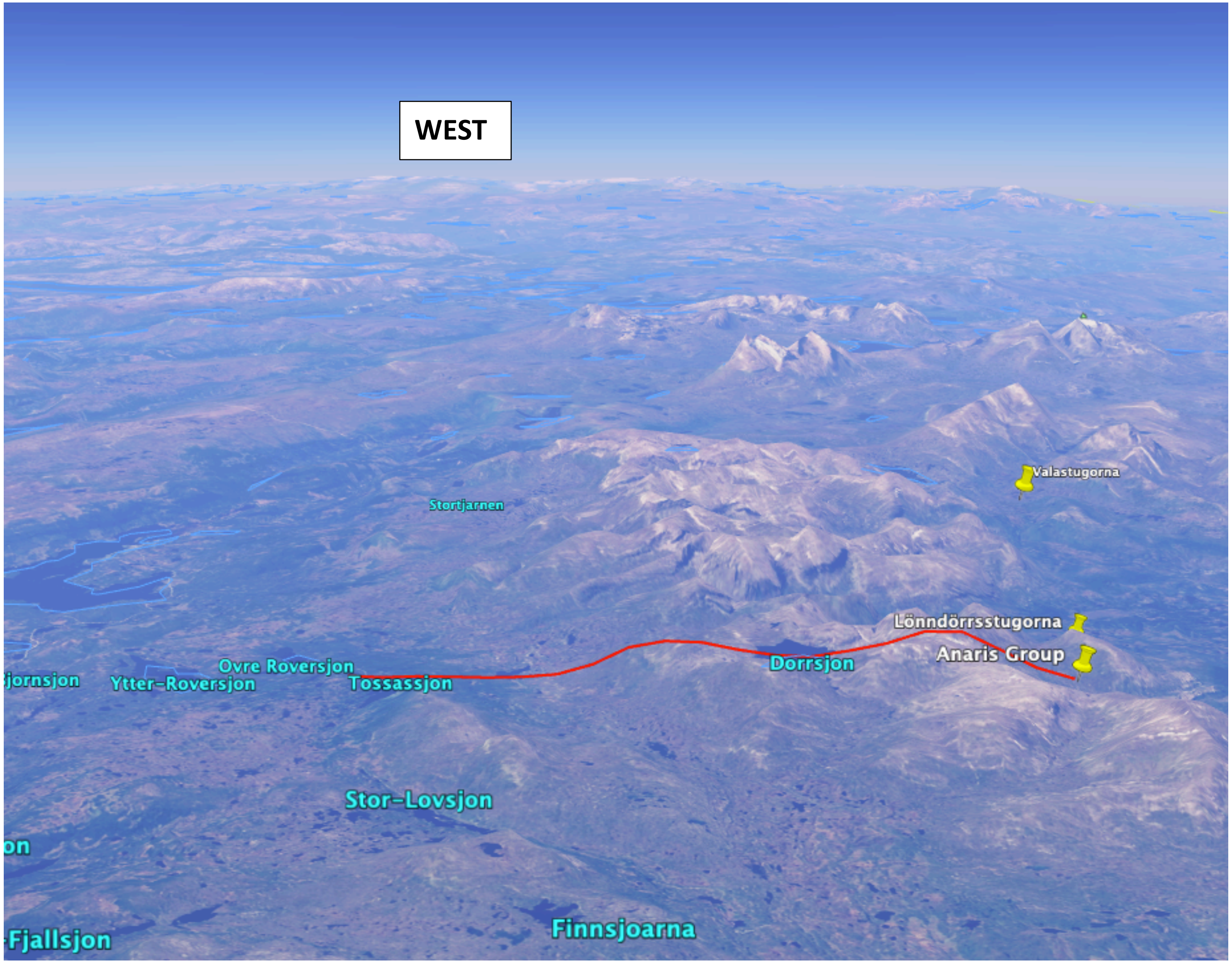


South *Google Earth Pro* **North**

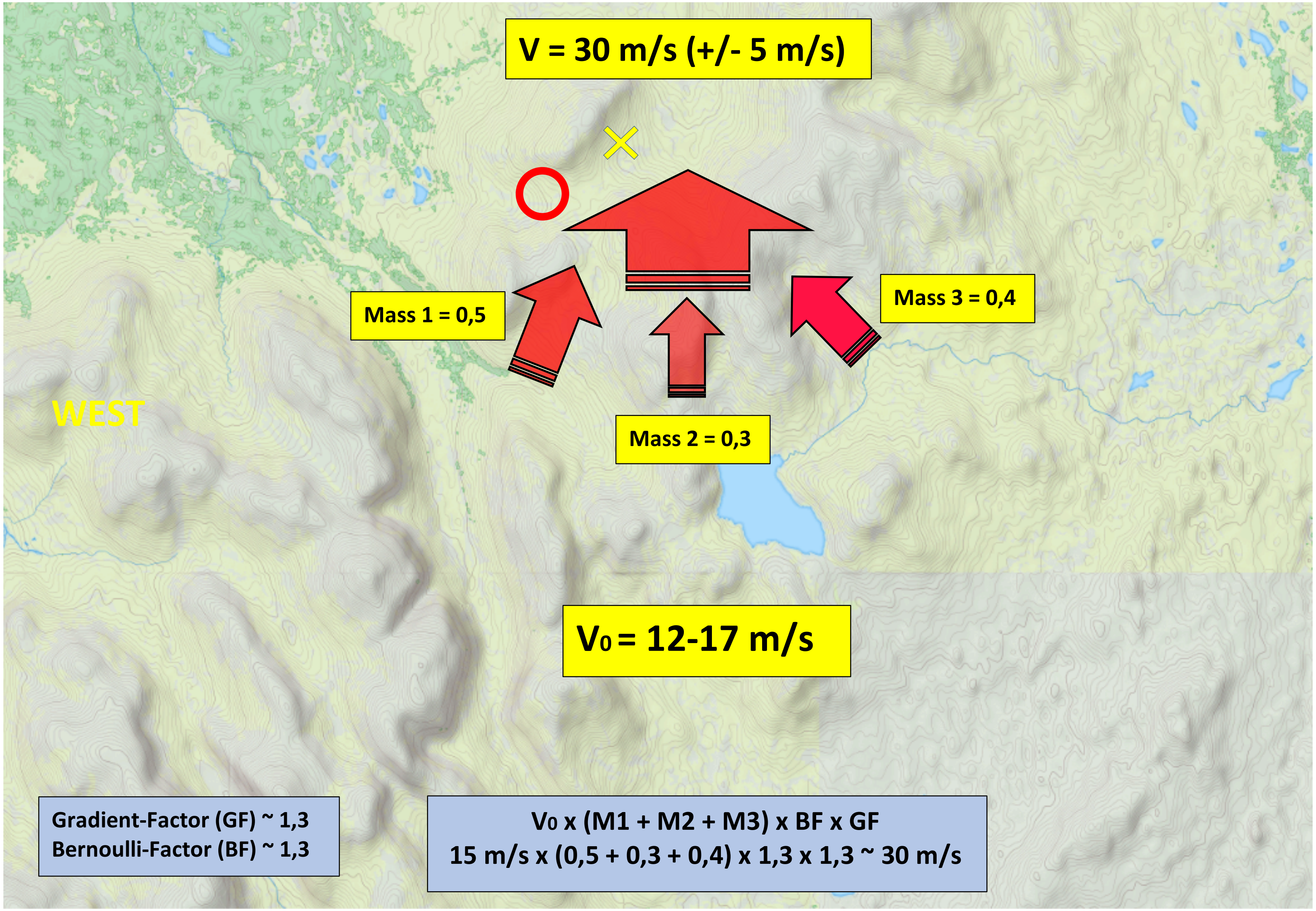
This is a plotted height profile of the mountain range. It corresponds to the red line in the image on page 10. As the schematic wind profile below shows, the wind speed must increase with altitude.



SOUTH

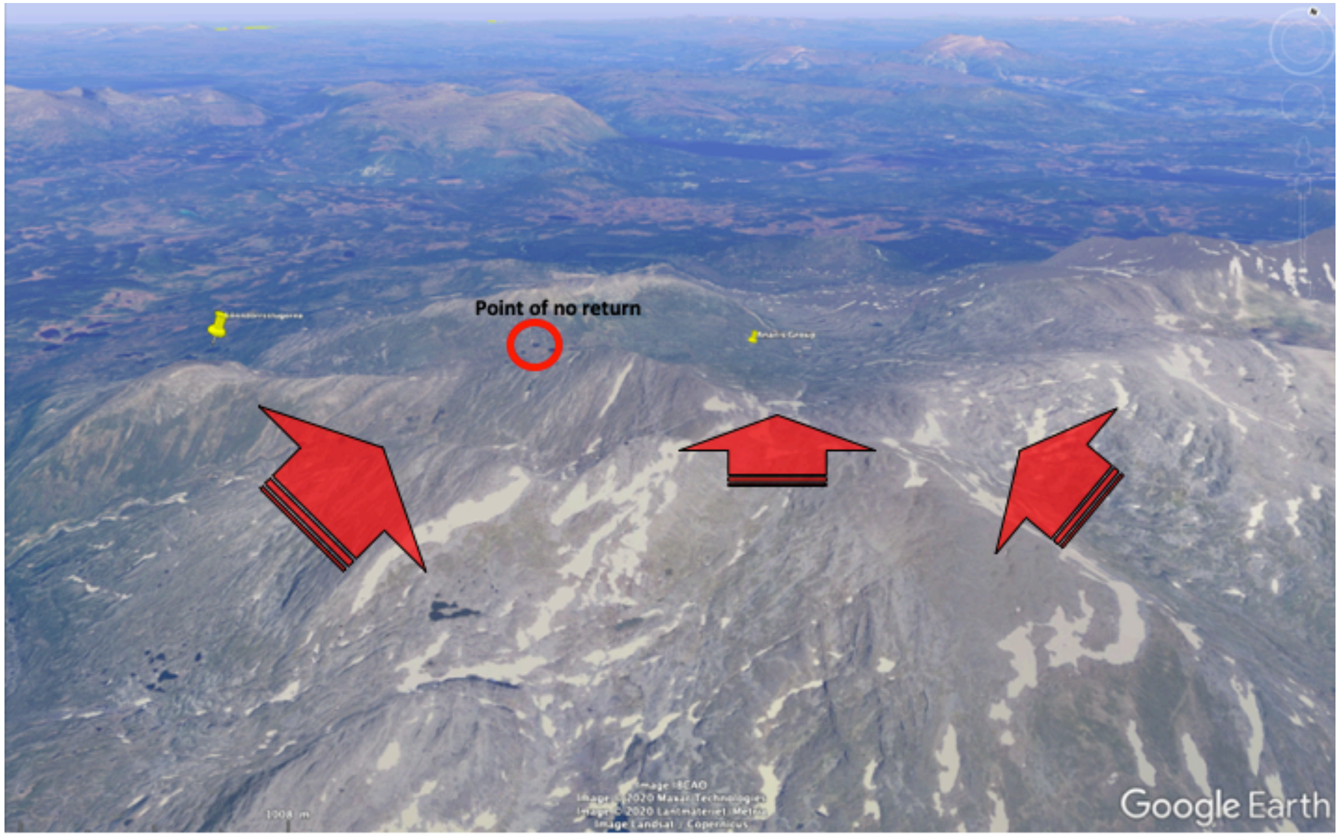


Google Earth Pro



V = 30 m/s (+/- 5 m/s)
Mass 1 = 0,5
Mass 3 = 0,4
Mass 2 = 0,3
WEST
V0 = 12-17 m/s
Gradient-Factor (GF) ~ 1,3
Bernoulli-Factor (BF) ~ 1,3
V0 x (M1 + M2 + M3) x BF x GF
15 m/s x (0,5 + 0,3 + 0,4) x 1,3 x 1,3 ~ 30 m/s

The wind speed is increasing (Bernoulli-Effect) because of 3 different masses that are gathering in the valley of the accident. Furthermore, since the wind speed increases with the height, it accelerates into a storm. At the red circle the group decided to go forward because a return to their start position would have meant a headwind.
As explained - this is also the point of no return with wind from the South.



The group can’t get deep enough under the snow.

https://www.svt.se/nyheter/lokalt/jamtland/atta-omkom-i-landets-svaraste-fjallolycka-anarisolyckan

The temporary roof of the bivouac eventually collapsed. Thus, the "Wind-Chill Effect" prevented any body heat to stay sufficient and frozen hands could no longer use the equipment. The only survivor was in constant movement and later found shelter in a wind-protected area.
The "Wind-Chill-Table" indicate a temperature decrease to - 40°C to - 45°C with wind of 30 m/s (+/- 5 m/s) and an outside temperature of -20°C. This temperature was only estimated, since no recording of the actual conditions were measured at the time of the accident.
The parallel to the Dyatlov group in 1959 is evident. As soon as the wind is able to remove any body heat due to a broken shelter or a tent, the cold becomes a deadly danger.

The hiking route is extremely dangerous because winds from the West, South-West and South can create a dangerous storm / G. Wolf.

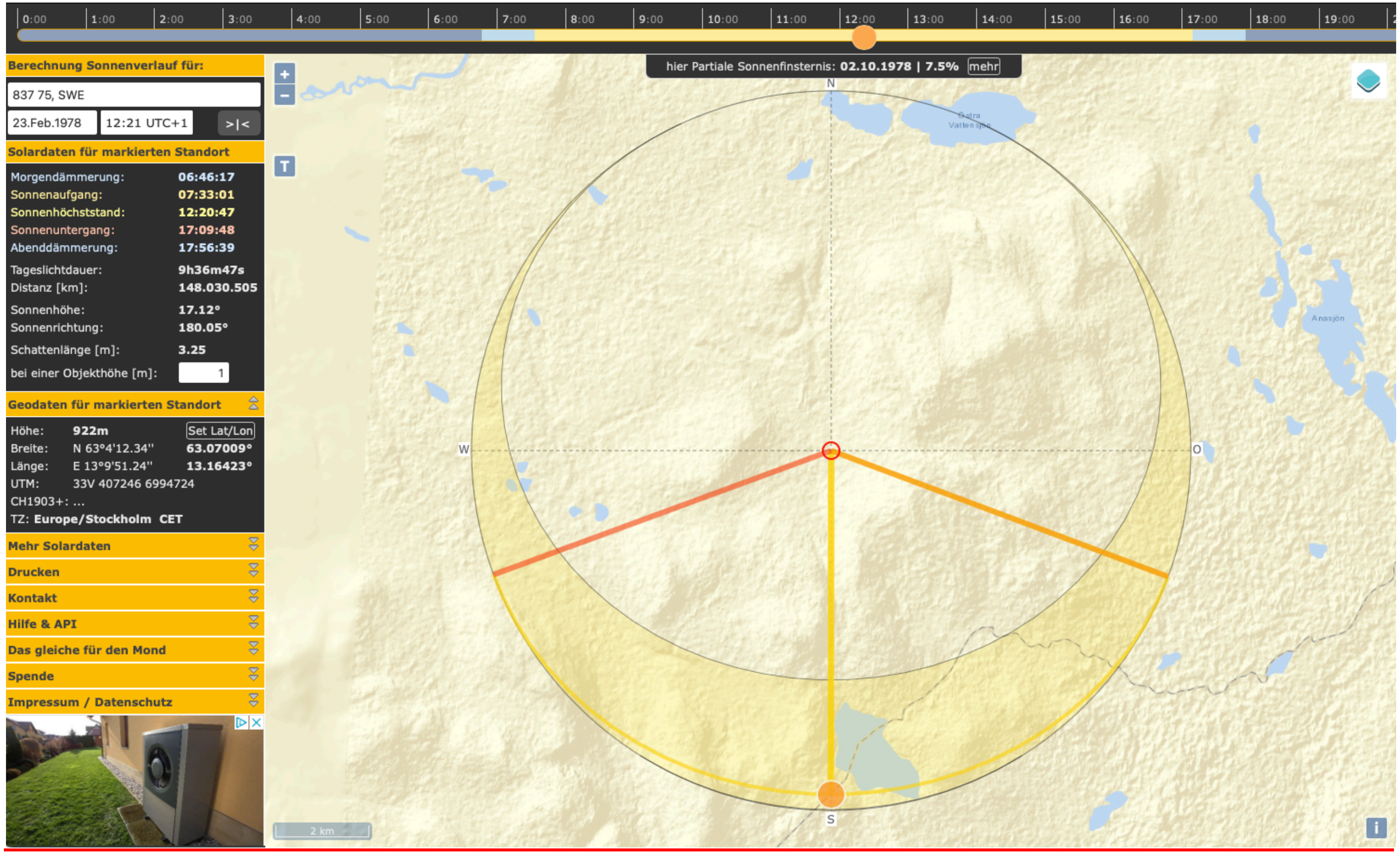
Katabatic-Wind

Was the Anaris accident influenced by a "Katabatic-Wind"?
One can say that a mixed form was present at Anaris. It can be described as a katabatic component.

The primary force of a Katabatic Wind is normally gravity.
Over a very cold surface, the air cools down and increases its density. On mountain flanks, the gravitational force (vertical downward force) then causes the air to move down into the valley. Furthermore, pressure compensation with warmer, less dense air is also possible - horizontally directed force.

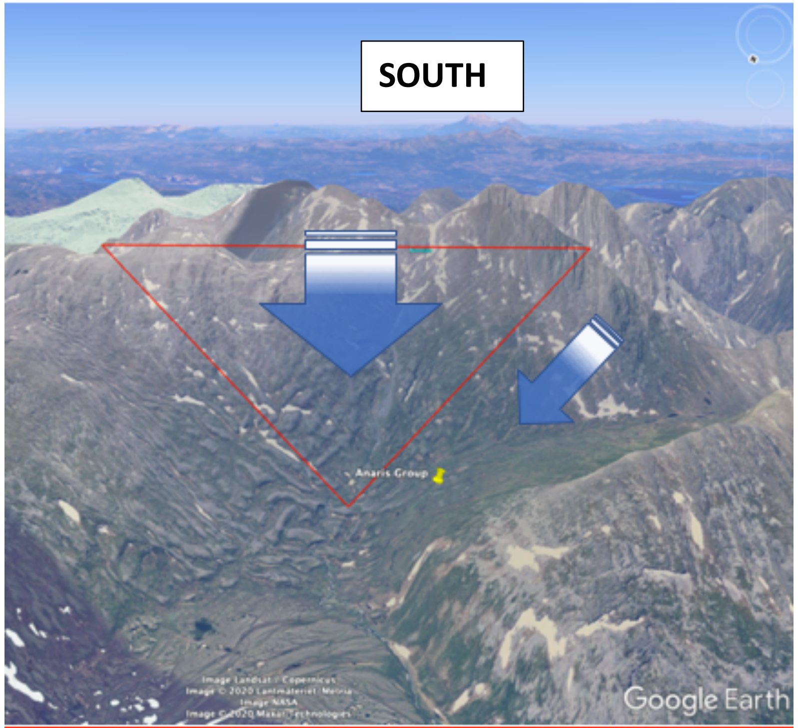
Kholat at the Dyatlov pass and the Anaris Mountains have the following similarities; crucial for the wind around Kholat is the western Sub-Valley which has an East-West orientation - with a 13% to 14% (~8°) slope to the north. From November to late February, the northern hillside (90 km²) is not exposed to the sun and therefore severely cooled down. The size of the northern flank is around 3 500m x 25 km.

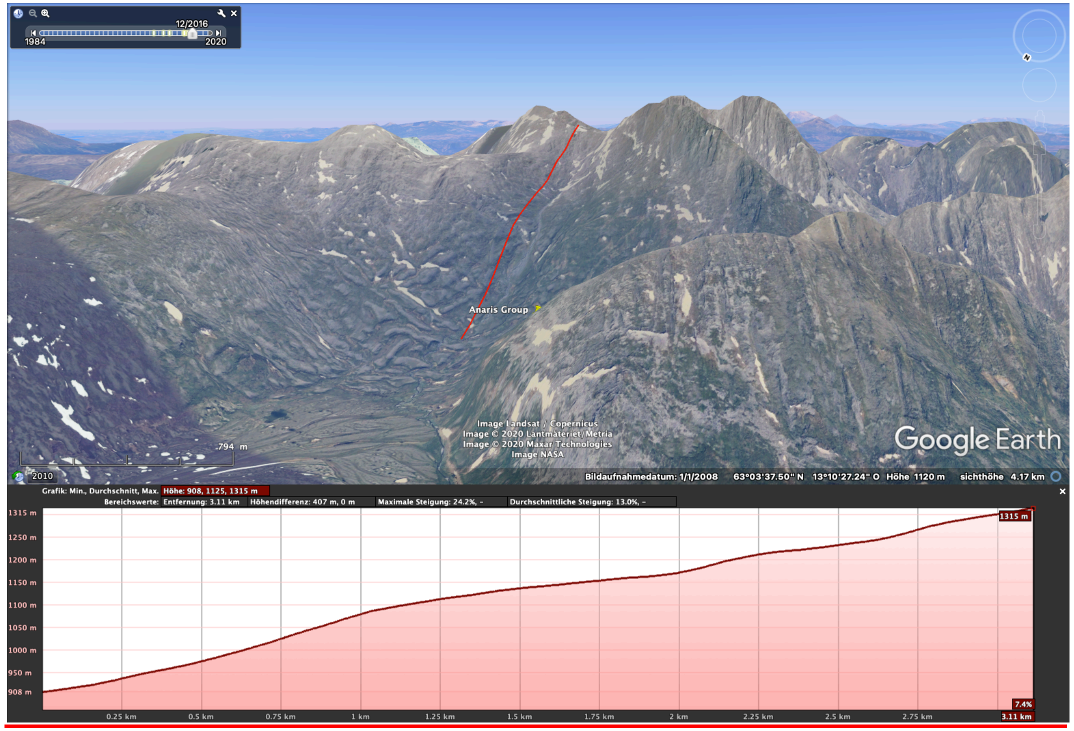
At the "Anaris Mountains", the north slope near the accident site (red triangle 10 km², ~13%-8°) is not exposed to the sun from October to the end of February and as such exceptionally cooled down.



South

https://www.sonnenverlauf.de/#/63.0701,13.1642,11.779999999999974/1978.02.23/12:21/1/3





The dimension of the triangle (left) have a 4 500 m side length and a 6 500 m upper base. This corresponds to 10 km² and the direct fall line is 3 200 m long (see below).

In the case of the Dyatlov accident, I have assumed a gravity fall wind of 3 m/s (up to 5 m/s with NW to N winds would also be possible). The following air masses are therefore, on the extremely cold northern hillside which is forested, about 1000 seconds before the air mass falls into the Pre-Valley where they accelerate severely.

In the Anaris Mountains, the storm blows the air over the cold hillside at ~30 m/s and takes 100 seconds to do so.

The residence times are 10:1.
The surface area at the "Kholat" is 10:1 in relation to the surface area at the Anaris.

At Kholat there were temperature jumps due to the “Katabatic Wind”, this up to -15°C.
The wind speed could have accelerated up to 15 m/s by the Katabatic force and influence the tent.
In strong scientific terminology, the "Katabatic-Wind" at Kholat is also a component of the weather there. But it adds 1/3 to 1/2 and therefore qualifies to be called a "Katabatic Wind" in its own name.

If the surface at Anaris had cooled down to -40°C, the temperature at the place of the accident would not have dropped more than - 3 to -5°. The wind speed would not have been influenced much. In this case, the temperature at the point of the accident would not be - 20°C, as was subsequently assumed, but maximum -25°C. The wind chill effect would then result in the temperature being -45° to -50°C.

The calculation of how a "Katabatic Wind" developed on Kholat and Anaris and how it affected the weather on the day of the accidents is easier to estimate on Kholat.
There have been numerous expeditions to Kholat that have documented the wind and temperatures and therefore I have been able to test my theories on the basis of these.
This has not been possible in the Anaris Mountains, where hiking groups usually cross the valley and spends the night in solid lodgings - available in large numbers.

If anyone would go to the site of Anaris at the same time of the year, the accident could be meteorologically clarified. A "Katabatic Fall-Wind" is best measured at night with several thermometers (and anemometer) at low wind speed under a cloudless sky. I assume nobody will ever do that.

In the Anaris case, with their broken bivouac, it wouldn't have made a difference whether the outside temperature was -20°C or -25°C - this since they were fully exposed to the wind.
The group member that was protected from the wind, -5°C was significant, but a temperature of -25°C was also survivable.

One must always reckon with a "Katabatic component" in the weather.
Especially when there is wind.

"The Wind plays its own music!"

Günter Wolf
Diploma-Physicist (M.SC.)