COURSE : DISASTER MANAGEMENT (MA/MSc PART I)
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INTRODUCTION

An avalanche (also called a snowslide) is an event that occurs when a cohesive slab of snow lying upon a weaker layer of snow fractures and slides down a steep slope. Avalanches are typically triggered in a starting zone from a mechanical failure in the snowpack (slab avalanche) when the forces of the snow exceed its strength but sometimes only with gradual widening (loose snow avalanche). After initiation, avalanches usually accelerate rapidly and grow in mass and volume as they entrainmore snow. If the avalanche moves fast enough, some of the snow may mix with the air forming a powder snow avalanche, which is a type of gravity current.

Nature of Avalnches

Although primarily composed of flowing snow and air, large avalanches have the capability to entrain ice, rocks, trees, and other surficial material. However, they are distinct from slushflows which have higher water content and more laminar flow, mudslides which have greater fluidity, rock slides which are often ice free, and serac collapses during an icefall. Avalanches are not rare or random events and are endemic to any mountain range that accumulates a standing snowpack. Avalanches are most common during winter or spring but glacier movements may cause ice and snow avalanches at any time of year. In mountainous terrain, avalanches are among the most serious objective natural hazards to life and property, with their destructive capability resulting from their potential to carry enormous masses of snow at high speeds.

Most avalanches occur spontaneously during storms under increased load due to snowfall. The second largest cause of natural avalanches is metamorphic changes in the snowpack such as melting due to solar radiation. Other natural causes include rain, earthquakes, rockfall and icefall. Artificial triggers of avalanches include skiers, snowmobiles, and controlled explosive work. Contrary to popular belief, avalanches are not triggered by loud sound; the pressure from sound is orders of magnitude too small to trigger an avalanche.

Avalanche initiation can start at a point with only a small amount of snow moving initially; this is typical of wet snow avalanches or avalanches in dry unconsolidated snow. However, if the snow has sintered into a stiff slab overlying a weak layer then fractures can propagate very rapidly, so that a large volume of snow, that may be thousands of cubic meters, can start moving almost simultaneously.

Preventative measures are employed in areas where avalanches pose a significant threat to people, such as ski resorts, mountain towns, roads, and railways. There are several

ways to prevent avalanches and lessen their power and deve preventative measures reduce the likelihood and size of avalanches by disrupting the structure of the snowpack, while passive measures reinforce and stabilize the snowpack in situ. The simplest active measure is repeatedly traveling on a snowpack as snow accumulates; this can be by means of boot-packing, ski-cutting, or machine grooming. Explosives are used extensively to prevent avalanches, by triggering smaller avalanches that break down instabilities in the snowpack, and removing overburden that can result in larger avalanches. Explosive charges are delivered by a number of methods including hand-tossed charges, helicopter-dropped bombs, Gazex concussion lines, and ballistic projectiles launched by air cannons and artillery. Passive preventive systems such as snow fences and light walls can be used to direct the placement of snow. Snow builds up around the fence, especially the side that faces the prevailing winds. Downwind of the fence, snow buildup is lessened. This is caused by the loss of snow at the fence that would have been deposited and the pickup of the snow that is already there by the wind, which was depleted of snow at the fence. When there is a sufficient density of trees, they can greatly reduce the strength of avalanches. They hold snow in place and when there is an avalanche, the impact of the snow against the trees slows it down. Trees can either be planted or they can be conserved, such as in the building of a ski resort, to reduce the strength of avalanches.

In turn, socio-environmental changes can influence the occurrence of damaging avalanches: some studies linking changes in land-use/land-cover patterns and the evolution of snow avalanche damage in mid latitude mountains show the importance of the role played by vegetation cover, that is at the root of the increase of damage when the protective forest is deforested (because of demographic growth, intensive grazing and industrial or legal causes), and at the root of the decrease of damage because of the transformation of a traditional land-management system based on overexploitation into a system based on land marginalization and reforestation, something that has happened mainly since the mid-20th century in mountain environments of developed countries.

Alarm systems

Modern radar technology enables the monitoring of large areas and the localization of avalanches at any weather condition, by day and by night. Complex alarm systems are able to detect avalanches within a short time in order to close (e.g. roads and rails) or evacuate (e.g. construction sites) endangered areas. An example of such a system is installed on the only access road of Zermatt in Switzerland.

Two radars monitor the slope of a mountain above the road. The system automatically closes the road by activating several barriers and traffic lights within seconds such that no persons are harmed.

Notable avalanches : Two avalanches occurred in March 1910 in the Cascade and Selkirk Mountain ranges; On March 1 the Wellington avalanche killed 96 in Washington State, United States. Three days later 62 railroad workers were killed in the Rogers Pass avalanche in British Columbia, Canada.

During World War I, an estimated 40,000 to 80,000 soldiers died as a result of avalanches during the mountain campaign in the Alps at the Austrian-Italian front, many of which were caused by artillery fire. Some 10,000 men, from both sides, lost their lives in avalanches in December 1916.

In the northern hemisphere winter of 1950–1951 approximately 649 avalanches were recorded in a three-month period throughout the Alps in Austria, France, Switzerland, Italy and Germany. This series of avalanches killed around 265 people and was termed the Winter of Terror.

A mountain climbing camp on Lenin Peak, in what is now Kyrgyzstan, was wiped out in 1990 when an earthquake triggered a large avalanche that overran the camp. Forty-three climbers were killed.

In 1993, the BayburtÜzengili avalanche killed 60 individuals in Üzengili in the province of Bayburt, Turkey.

A large avalanche in Montroc, France, in 1999, 300,000 cubic metres of snow slid on a 30° slope, achieving a speed in the region of 100 km/h (62 mph). It killed 12 people in their chalets under 100,000 tons of snow, 5 meters (16 feet) deep. The mayor of Chamonix was convicted of second-degree murder for not evacuating the area, but received a suspended sentence.

The small Austrian village of Galtür was hit by the Galtür avalanche in 1999. The village was thought to be in a safe zone but the avalanche was exceptionally large and flowed into the village. Thirty-one people died.

On December 1, 2000, the Glory Bowl Avalanche formed on Mt. Glory which is located within the Teton Mountain Range in Wyoming, United States. Joel Roof was snowboarding recreationally in this backcountry, bowl-shaped run and triggered the avalanche. He was carried nearly 2,000 feet to the base of the mountain and was not successfully recovered.