HUMAN ACTIVITIES VS AVALANCHE

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INTRODUCTION

Avalanches are rapid downward movements of snow, ice, and debris that pose significant risks to human life, infrastructure, and the environment, particularly in alpine regions like Davos, Switzerland. Their frequency and severity are influenced by various factors, including weather conditions, terrain, and human activity. While rising global temperatures are expected to shift avalanche dynamics from dry to wetter, potentially more destructive avalanches, their overall frequency remains debated. Some studies suggest that warming leads to fewer avalanches due to increased vegetation stabilizing slopes, while others report no significant change. Additionally, although no direct studies link tourism to avalanche frequency, the rising popularity of backcountry skiing and winter sports has increased human-triggered avalanche incidents. This study explores the relationship between seasonal temperature variations, tourist activity, and avalanche frequency in Davos to better understand how climate change and human presence impact avalanche risks, aiding in improved forecasting and risk management strategies.

METHOD

A survey on avalanche safety was conducted using posters placed at key mountain locations and a school-wide email containing a link to an interactive quiz. The quiz assessed knowledge on avalanche safety, including slope angles, escape possibilities, sounds, injury prevention, and necessary equipment. Avalanche data from EnviDat (1999-2019) and tourism data from the Swiss Federal Statistical Office (2013-2019) for Davos were analyzed, focusing on human-triggered avalanches and tourism arrivals and overnight stays. Temperature data from NASA's MODIS LST product was integrated to explore the relationship between thermal conditions and avalanche occurrences. Data was processed and analyzed using Python, Numpy, and Pandas in Jupyter Notebook to identify patterns between temperature variations, snow conditions, and avalanche triggers.

CONCLUSION

Survey data suggests that many people in high-risk avalanche areas, including tourists and residents, lack essential knowledge about avalanche safety. A significant issue is the unfamiliarity with necessary safety equipment, which could be addressed through better training programs. However, high costs remain a barrier, particularly for tourists. Advancements in engineering, government subsidies, and improved accessibility could help make safety gear more affordable. Additionally, difficulties in estimating slope angles and identifying avalanches by sound highlight the need for better tools and educational resources, such as slope angle measuring devices and audiovisual warnings at ski resorts.

The correlation between tourism and avalanche frequency is weak, suggesting that natural factors like snowfall, temperature, and wind patterns play a more significant role in avalanche formation. However, increased human presence might lead to a higher number of reported avalanches simply due to more witnesses. Despite the weak correlation, peak tourist seasons still pose a higher risk, emphasizing the need for better awareness and safety measures.

Temperature analysis shows that short-term day-to-night temperature changes have little impact on avalanche frequency, but long-term warming trends may lead to an increase in wet avalanches. These avalanches, caused by melting snow and water saturation, tend to be more destructive than dry avalanches. Due to their higher density and weight, wet avalanches move more slowly but exert immense force, making escape nearly impossible and causing severe structural damage to infrastructure like roads, ski resorts, and buildings. As climate change alters snowpack stability, future research should focus on refining avalanche forecasting models to improve risk assessments and mitigation strategies.

RESEARCH QUESTION

How do monthly temperature variations and levels of winter tourism influence the frequency and type of avalanches in Davos, Switzerland?

MAKING A DIFFERENCE

SCAN ME

- Avalanche Safety Quiz at Le Rosey
  - Distributed to all students (127 responses) to assess and improve awareness of avalanche risks and safety measures.
- Multilingual Public Quiz via Posters
  - Installed in high-risk mountain areas (Eggli, Schönried & Saanenmöser) with QR codes linking to an interactive quiz, available in English, French, German, and Romanian.
- Educational Posters in Ski Areas
  - Highlighted key facts like slope angles, decision making process, and essential safety equipment—placed where visitors would see them.
- Presentation to the School Community
  - Shared our findings on avalanche types, climate influence, and tourism links to promote safer practices and awareness.
- Social Media Campaign
  - Created Instagram and other social media accounts to share research insights, safety tips, and climate data visuals.
- Interactive Avalanche-Themed Puzzles
  - Designed to engage students and reinforce knowledge through gamified learning.
- Website
  - A hub for our research, safety resources, and interactive tools to continue spreading awareness beyond our school.

Figure 1: Monthly number of overnight stays vs avalanche frequency

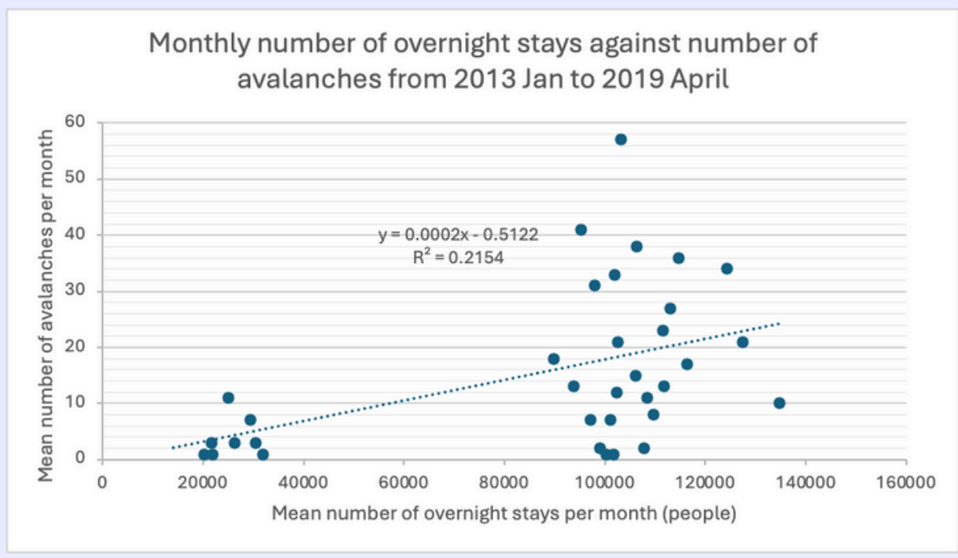

Figure 2: Monthly average temperature vs dry and wet avalanche frequency