Geophysical Research Abstracts, Vol. 9, 06142, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06142


# Use of Airborne LiDAR to Support Monitoring and Emergency Response Planning at Turtle Mountain, Alberta Canada

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Over the past three years a number of multidisciplinary studies have been undertaken to compliment the ongoing monitoring at Turtle Mountain, Alberta, Canada, in order to aid in the development of a warning and emergency response plan for unstable portions of the mountain. Recently acquired airborne light detection and ranging (LiDAR) was utilized to generate a high resolution digital terrain model (DTM) of the entire mountain. By utilizing new GIS-based tools for structural mapping, higher densities of bedding and joint orientation data have allowed for an updated interpretation of the style of movement of the 1903 Frank Slide and ongoing movements of the headwall and South Peak. The generation of a 0.5 metre resolution bare earth model has allowed for the interpretation of surface morphology that has lead to a re-interpretation of the style and direction of movement of a 0.5 million $m^3$ mass at the crest of South Peak and has also shown features further to the south that have lead to an expansion of the understanding of the potential movement volume and understanding of the global stability of the mountain. Displacement features below an area known as Third Peak indicate that previously estimated volumes for a failure mass and run-out zones are likely underestimated. These observations have lead to the design of additional monitoring to the south of the existing sensor networks in order to characterize these movements and determine whether additional areas are susceptible to the rock slope movement. In addition, the observation of a surface features consistent with those of a historic large slope failure, south of the study area, highlight the tenuous state of

stability of the entire mountain.