Geophysical Research Abstracts
Vol. 12, EGU2010-10545-2, 2010
EGU General Assembly 2010

The Tjarnardalir landslide, in central north Iceland - recent movements, causes and triggering factors

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The Tjarnadalir landslide is located in the Almenningar area, in the outermost part of the Skagafjörður fjord, in central north Iceland. The landslide is a part of an extensive landslide area on the eastern side of the fjord.
Since 1977 the Icelandic road authority has carried out measurements on the moving debris bodies in the Almenningar area, as the only whole year road to the town of Siglufjörður leads through the landslide area. Since the road was constructed, more than 40 years ago, extensive damages have occurred to the road, often causing hazardous conditions.
The Tjarnardalir landslide originates from the western side of the Mánarfjall Mountain. The scar of the landslide is about 800 m long from north to south and about 850 m long from east to west. The mean width of the slide is around 1400 m and mean length about 1550 m. The total volume of the slide is estimated to be at least 110,000,000 m^3. The front of the landslide reaches the present coast, forming up to 60 m high coastal cliffs that show clear evidence of extensive coastal erosion. The frontal part of the landslide can be divided into two zones. The southern one, reaching from the Kóngsnef cliff, south to the Kvígildi hill, is characterized by a 450-500 m wide and 250-300 m long slide scar. The main and only whole year road to the town of Siglufjörður is situated inside the scar, about 100-250 m from the coastline, which forms about 20-30 m high sea cliffs there. In this area measurements show westward movement with mean rate up to 60 cm/year. The northern zone of the landslide, from the Kóngsnef cliff north to the Skriðnavík cove, is characterized by up to 60 m high steep coastal cliff. In this part the road is situated 20-50 m from the cliff edge, at about 80 m height. A steep 30-40 m high slope is located above the road. The costal erosion in this part of the landslide is extensive, and the slope below the road shows clear signs of slide movement. Several large U-shaped failures have formed in and above the road itself. Measurements in this area show westward movement with mean rate up to 26 cm/year.
The stratigraphical record of the coastal cliffs shows fine grained (silt/fine sand) sediments underlying the landslide material. There the groundwater, which penetrates through the overlaying coarse landslide material, stops and forms a sliding plain. It is assumed that main part of the landslide movement takes place on this boundary.
A clear correlation occurs between the landslide movement and meteorological conditions. The main sliding movements occur from April to June, i.e. during the snow-melt period and from August to October, i.e. during the autumn rain period. It is also known that extensive coastal erosion occurs, but its impact in the sliding movement is not fully understood.