Landslide activity peak of late 1980's in Central Yamal, Russia, observed from satellite image time series

Timo Kumpula (1), Tatiana Mikhaylova (2), Natalia Ukraintseva (2), and Bruce Forbes (3)

(1) Department of Geography and history, University of Eastern Finland, Joensuu, Finland (timo.kumpula@uef.fi), (2) Earth Cryosphere Institute Siberian Branch of Russian Academy of Science (ECISBRAS), , (3) Arctic Centre, University of Lapland,Rovaniemi, Finland

T. Kumpula1 T. Mikhaylova2, N. Ukraintseva2 & B.C. Forbes3
1 Department of Geography and history, University of Eastern Finland, Yliopistonkatu 7, 80101 Joensuu, Finland; timo.kumpula@uef.fi
2 Earth Cryosphere Institute Siberian Branch of Russian Academy of Science (ECISBRAS),
3 Arctic Centre, University of Lapland, Box 122, 90601 Rovaniemi, Finland

A large set of cryogenic landslides occurred in Bovanenkovo region in Central Yamal peninsula, Arctic Russia in late 1980's. Database of satellite images was collected to follow landslide activity 1969-2011. Imagery used were CORONA, Landsat MSS/TM/ETM7, SPOT, Terra ASTER VNIR and Quickbird-2 images from years 1969, 1988, 1993, 1998, 2001, 2004 and 2011. Field data was collected from several years and sites. Earliest data was collected in 1993. More recent data was collected in 2004 and 2005. Main field data was collected in 2011 from Mordy-Jaha landslide field.

CORONA image from 1969 is used as a starting date of analysis. Landsat TM image dated from 1988 just before the main landslide event in 1989. This image was compared to SPOT (1993,1998), Landsat ETM+ (1999, 2001), Landsat TM (2011) and Terra ASTER VNIR (2001) images to detect occurred landslides. Quickbird-2 (2004) (QB) images were used to help the interpretation of the SPOT and Landsat images and to detect small scale landslides (< 1 ha). All identified landslides were saved into a GIS database as points and the boundaries of the landslides were digitized. From SPOT, Landsat, ASTER and Quickbird-2 images bare soil were classified both with unsupervised and supervised methods. Characteristic spectral reflectance of landslides was estimated and images were reclassified.

Change detection using NDVI verified well larger scale landslides, but was not generally reliable enough alone to estimate the occurrance and areas of the landslides. Errors caused by nearby Bovanenkovo gas fields anthropogenic disturbances like roads, quarriers and other infrastructure around the gas field were masked out with buffers. In data analysis we used ERDAS Imagine 2011 and ArcGIS 10. Final estimation of landslide occurrence was made with combined visual interpretations, change detection (NDVI), image classifications. Totally in the study area there were about 600 landslides.