Glacier Routes in High Mountain Maps – a No-Chance Challenge for Cartographers

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Introduction

• Changing tracks due to extensive trekking tourism, transport necessities and hazardous geomorphological side-effects
• Highly dynamic track changes in areas of glacier retreat – Changes from one day to another
• Identification of trails by means of remote sensing is difficult due to resolution limitations
• Field work is needed for verification.
Introduction

- Trail characteristics in high mountain areas
http://menris.icimod.net/menris/Photogallery/default.aspx?PhotoCatID=4
GPS-Tracks 10/2008

Destroyed bridge
Trail Ambiguities

20/09/2013

Glacier Routes in High Mountain Maps

Page 6
• Trail mapping using high resolution satellite imagery Cartosat-1
Glacier Changes

- In glacier free areas trails can be mapped using high resolution satellite imagery
- Glacier retreat and glacier meltwater discharge are influencing paths running along glacier meltwater fed rivers
- Glacier tongue crossing tracks are heavily influenced by debris cover and supraglacial ponds

How to deal with the problem of dynamic changing routes in glacial environments in topographic maps?
Glacier Changes

- Khumbu-Gletscher 1952
- (http://www.sfar-evev06.ch/en/topics/bilder.html)

- Khumbu-Gletscher 2008
Glacier Changes

A. Strong increase

B. Increase

C. Increase

D. No significant change

Bolch et al. 2008
Changing glacier characteristics

Crevasses, lakes, debris cover
approx. glacier route 2008

???
Trail Mapping

20/09/2013

Glacier Routes in High Mountain Maps
GPS: Global Positioning System

Requirements:

- Stable over time
- Clearly identifiable in satellite imagery and reality
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Thank you for your attention.