



## **Monitoring glacier variations in the Urubamba and Vilcabamba Mountain Ranges, Peru, using “Landsat 5” images**

Wilson Suarez (1), Marcos Cerna (1), Julio Ordoñez (1), Holger Frey (2), Claudia Giráldez (2), and Christian Huggel (2)

(1) National Meteorological and Hydrological Service of Peru (SENAMHI), (2) Department of Geography, University of Zurich

The Urubamba and Vilcabamba mountain ranges are two geological structures belonging to the Andes in the southern part of Peru, which is located in the tropical region. These mountain ranges are especially located within the transition area between the Amazon region (altitudes close to 1'000 m a.s.l.) and the Andes. These mountains, with a maximum height of 6'280 m a.s.l. (Salkantay Snow Peak in the Vilcabamba range), are characterized by glaciers mainly higher than 5000 m a.s.l.

Here we present a study on the evolution of the ice cover based on “Landsat 5” images from 1991 and 2011 is presented in this paper. These data are freely available from the USGS in a georeferenced format and cover a time span of more than 25 years.

The glacier mapping is based on the Normalized Difference Snow Index (NDSI). In 1991 the Vilcabamba mountain range had 221 km<sup>2</sup> of glacier cover, being reduced to 116.4 km<sup>2</sup> in 2011, which represents a loss of 48%. In the Urubamba mountain range, the total glacier area was 64.9 km<sup>2</sup> in 1991 and 29.4 km<sup>2</sup> in 2011, representing a loss of 54.7%. It means that the glacier area was halved during the past two decades although precipitation patterns show an increase in recent years (the wet season lasts from September to April with precipitation peaks in February and March).

Glacier changes in these two tropical mountain ranges also impact from an economic point of view due to small local farming common in this region (use of water from the melting glacier). Furthermore, potential glacier related hazards can pose a threat to people and infrastructure in the valleys below these glaciers, where the access routes to Machu Picchu Inca City, Peru's main tourist destination, are located too.