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Mass Balance of Glaciers in Mt. Xixiabangma Derived from Multi-source DEMs

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INTRODUCTION

- Glacier mass balance, as a direct indicator of climate change, attracted increasing attention in the field of cryosphere.
- Under the projected scenarios of a warming climate in future, water availability which is related to glacier dynamics will be of high concern due to accelerated glacier melting.
- Measuring the region-wide glacier mass balance plays a significant role in understanding the response of glaciers to climate change and their influence on water resources and glacial hazards.

OBJECTIVE

Mt.Xixiabangma is located in the middle of the Himalayas (see Fig.1), with an height of 8012 m above sea sevel. It is one of the centers of modern glaciers in the Himalayas. Glacier meltwater is of high importance for the run-off, but the exact share is not known. In addition, we calculate glacier mass balance to provide some reference information for predicting the possibility of glacial lake outburst flood.

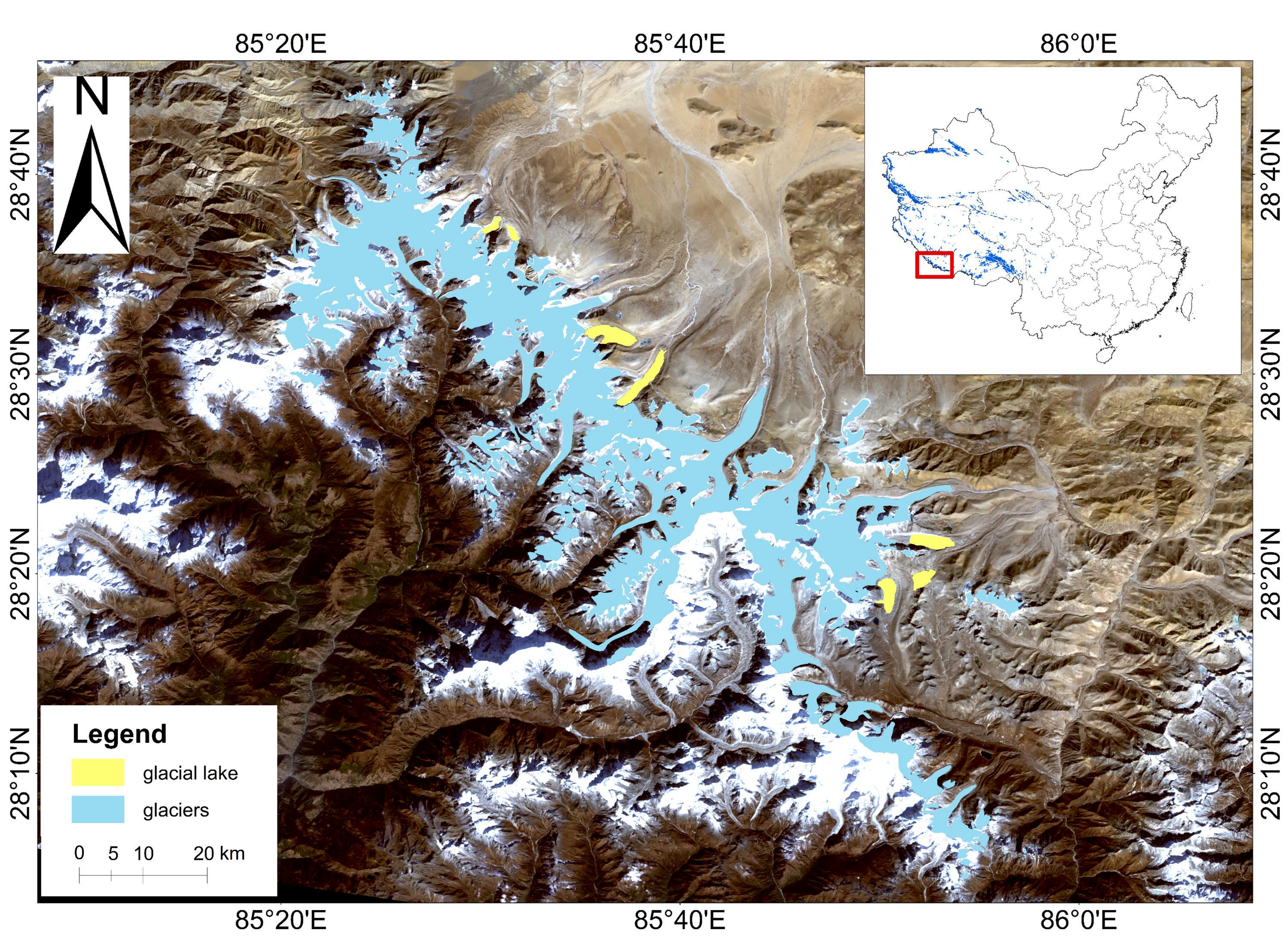

Fig.1: Overview of study area

METHODS

Using geodetic methods based on digital elevation models (DEMs) derived from 1974 KH-9 Hexagon, 2000 SRTM1 and 2012 TanDEM-X datasets (Table 1). All KH-9 DEMs were derived from stereo image pairs. We obtained DEMs from radarsatellite TanDEM-X based on the aynthetic aperture radar interferometry technology.

In order to obtain accurate elevation changs, DEMs must be co-registrated. In this study, we employed the method proposed by Nuth (Nuth and Kääb 2011).

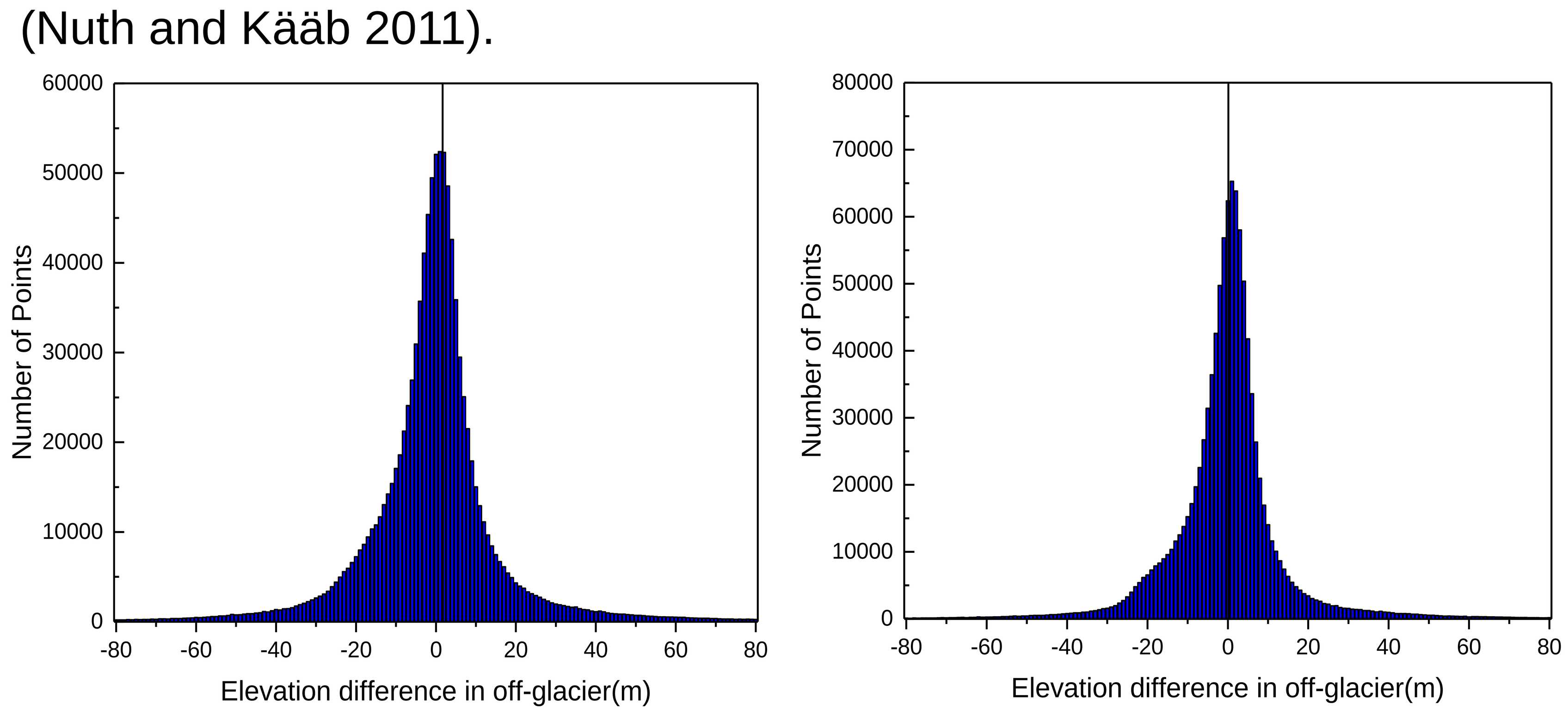

Fig.2:Elevation differences estimated between TanDEM-X and SRTM before (left) and after (right) co-registration.

Table 1. Overview of satellite images and data sources.

Data	Image ID/Path-row	Time	Resolution	Usage
KH-9	DZB1209-500101L005001 DZB1209-500101L006001 DZB1209-500101L007001 DZB1209-500101L008001	11/1974	7.6m	DEM
SRTM	n28e085	2/2000	30m	DEM
Landsat ETM+	141/039 141/040 141/041	10/2000 11/2000 11/2000	30m	Glacier mapping/ Reference dataset
TanDEM-X		2/2012 3/2012	10m	DEM

RESULTS

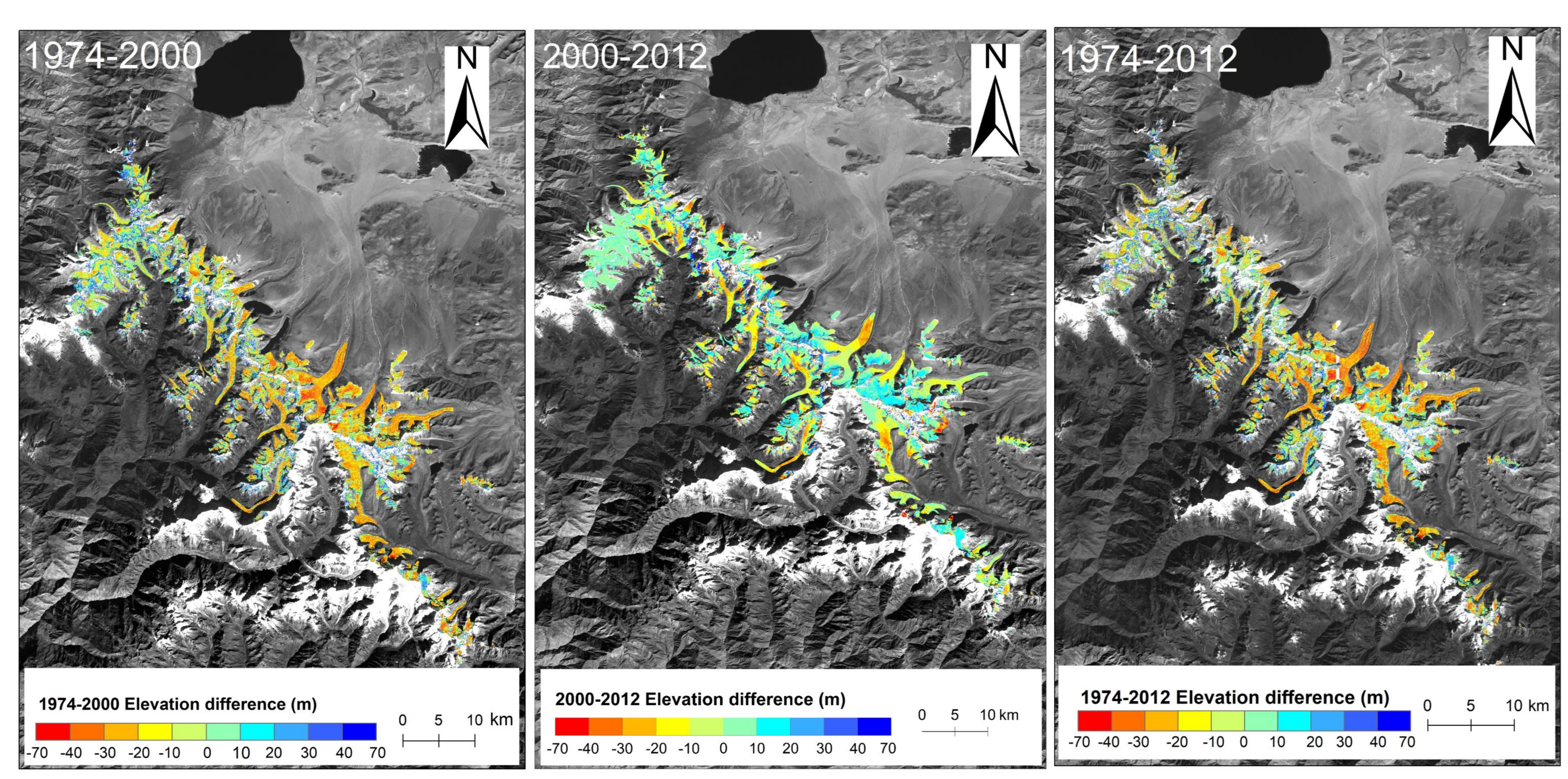

Fig.3: Elevation difference maps for the 1974-2000, 2000-2012 and 1974-2012 time period.

As shown in Fig.3, most of glaciers show a significant surface lowering in the ablation areas for the 1974-2000, 2000-2012 and 1974-2012 time periods. A glacier average density of 850±60 kg m^{-3} has been used to convert the volume change into mass budget(Huss,2013). The overall mass budgets of the investigated glaciers for the 1974-2000, 2000-2012 and 1974-2012 time periods were -0.30±0.04m w.e.a^{-1},-0.24±0.06m w.e.a^{-1} and -0.29±0.03m w.e.a^{-1}. We also found glaciers in the south experienced a more severe thinning than those in the north.

PERSPECTIVE

- We will further analyze uncertainty and the characteristics of glaciers change.
- Glaciers are considered to be the indictors of climate change, we will further explore the relationship between glaciers and climate change.

MAJOR REFERENCES

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