Author's response:

We thank the reviewers for their careful examination of our manuscript. They have posed many excellent questions and have made many suggestions which we have, or will shortly implement into a revised manuscript.

F. Paul Review:

1) The 1973 MSS scene has been reanalyzed and the ground ice has now been reclassified and the ground ice is no longer identified as glacier ice (See attached Fig.2).
2) Changes to the introduction: We agree with the editing and content suggestions, and have incorporated the changes suggested in the review. As suggested, a focus of the paper is now on remote sensing methods and we have compared the results of five different glacier mapping methods to assess uncertainties and to support the validity of our results (See attached Fig.15, 16 and Table 4). In this sense, we have expanded on Ye et al. (2006) by more than just extending the time series.
3) Study area: We agree with the editing and content changes suggested. We have taken the suggestion to divide the glaciers into their respective drainage basins. This area lies within six watersheds, three of which end in the Yangtze River, two end in the Chibzhangcuo Lake, and one ends in the Selincuo Lake (See attached Fig.13,14 and Table 6). Analyses for the contiguous glacier complexes are also included. Details of advancing and retreating glaciers is now presented (See attached Fig3, 5-11).

   More detail is given on the unsupervised classification technique.
   The CBERS scene from 2011 was replaced with a 2009 Landsat scene.
4) Data and Methodology: This section has been restructured. The CBERS scene has been replaced with a 2009 Landsat scene, which is snow free and cloud free. A comparison of 5 classification methods (Manual, Ratio, NDSI, Unsupervised, Supervised) have been made, and examples of the different classification methods shown (See attached Fig.15, 16 and Table 4). We have added close-ups illustrating the land-ice conditions (See attached Fig.3, 5-11). We have described the classification methods in full.
5) Results: We have made the following changes.
   Units have been changed to km^2.
   Tables have been added and the call out in the text has been reduced.
   New figures have been generated taking the suggestions of the reviewer.
   Discussion section has been added.
   Glacier complexes have been divided into drainage divides.

We will provide area changes versus glacier size, and are considering how this will be presented.

We are now referring to advancing glaciers and now surging glaciers.

An assessment of seasonal snow has been included.

We will summarize similarities in glacier changes observed.

6) Conclusions:

Our result show that glaciers retreat was speeding up before 2004, but slowing down after 2004 (See attached Table 2).

We no longer use the CBERS 2011 scene and have replaced it with a 2009 Landsat scene.

We have removed discussion of ice volume change, since it is beyond the scope of this study.

A table has replaced Figs. 3-6, and a scatterplot is being considered.

Close up's have been added.

We appreciate the references provided and will include them.

M. Pelto Review:

1) We agree that at higher elevations seasonal snowcover would be more extensive in June than in July and August. Fortunately the June 1973 image is snow free and clear. But there are many river ices on this scene. We use manual method distinguished the river ice from the glacier (See attached Fig.2). Discussion added for potential issues in this region for using a June versus an August or September issue。
2) We will include a comparison of changes from 1973-1992 and 1992-2009.
3) We will update the references identified.
4) Wikipedia references removed.
5) We will use the terminology advancing glaciers and not surging glaciers.
6) The 1973 MSS scene has been reanalyzed and the ground ice has now been reclassified and the ground ice is no longer identified as glacier ice. We have quantified the size of the areas lost (See attached Fig.2).
7) Some further glaciers lost 1992-2009.
8) Proglacial lakes at the end of glacier exiting ice mass C expanded (See attached Fig.17 and Table 7)
9) We will put the data from Figs. 3-6 into a table. (See attached Table 1,2)
10) We appreciate the references provided and will include them.

D. Quincey Review:

Response to major comments:

1) We have shifted the focus of this paper to a comparison of 5 different glacier boundary mapping methods, and an integrated examination of changes occurring to a glacier complex over time.

2) We subseted a piece of image from 1992 Landsat scene and got the glaciers area by using four automatic methods (Ratio, NDSI, Unsupervised, Supervised). We found that unsupervised result is closest to the visual interpretation result (See attached Fig.15, 16 and Table 4)
3) A discussion section has been added.

Response to minor comments:

1) We agree that precipitation changes are also important; text has been changed.
2) We are no longer using a CBIRS scene.
3) Units have been changed to km^2.
4) Advancing and retreating now used.
5) The speculation on water availability has been removed.
6) We agree with the awkward terminology – now using mountain glacier.
7) Removed the statement on future frozen water.
8) The URL's have been removed and the references replaced.
9) The CBERS 2011 scene has been replaced with a 2009 Landsat scene. So now all of the scenes come from USGS. These scenes are orthorectified by USGS and matched very well.
10) We use ISODATA (Iterative Self-Organizing Data Analysis Technique) as the unsupervised algorithm.
11) By comparing the manual result and the unsupervised result, we found that unsupervised classification accuracy of < 1 pixel be achieved (See attached Fig.15, 16 and Table 4).
12) We recalculated plus-minus uncertainty estimates, and text has been changed.
13) We agree that numbers of drops in loss rate would be better tabulated rather than described in text. Table has been added now (See attached Table 2).
14) We will use the terminology advancing glaciers and not surging glaciers.
15) Tables have been added.
16) The focus of the paper have changed to glacier complexes.
17) Figures 3, 4, 5, 6 have been simplified into a table.
18) We have fixed the figure to include the axis label. Error bars have been added. Now using a 2009 Landsat scene instead of the 2011 CBIRS scene.

Table

Table 1 Glacier area in study area and the three largest contiguous ice masses (km^2)

Year	1973	1992	2004	2009
Total	1019.83±55.48	993.15±32.85	943.40±22.30	924.49±28.57
A	79.13±3.62	78.39±2.14	75.24±1.74	74.93±1.76
B	196.22±8.94	190.41±4.91	183.06±3.66	181.14±4.69
C	663.19±27.07	637.70±16.06	609.45±11.12	599.12±15.17

Table2 Glacier change in study area and the three largest contiguous ice masses

		1973-1992	1992-2004	2004-2009	1973-2009
Glacier change(km^2)	Total	-26.68	-49.75	-18.90	-95.33
	A	-0.20	-3.69	-0.31	-4.19
	B	-5.81	-7.35	-1.92	-15.08
	C	-25.49	-28.25	-10.32	-64.07
Speed of change(km^2yr^{-1})	Total	-1.40	-4.15	-3.78	-2.65
	A	-0.01	-0.31	-0.06	-0.12
	B	-0.31	-0.61	-0.38	-0.42
	C	-1.34	-2.35	-2.06	-1.78
Rate of change(% $year^{-1}$)	Total	-0.14	-0.42	-0.40	-0.26
	A	-0.01	-0.39	-0.08	-0.15
	B	-0.16	-0.32	-0.21	-0.21
	C	-0.20	-0.37	-0.34	-0.27

Table 3 Glacier transformation in study area (km^2)

	1973-1992	1992-2004	2004-2009	1973-2009
Glacier to non-glacier	59.24	59.74	31.01	106.98
Non-glacier to glacier	32.56	9.99	12.11	11.65

Table 4 The precision of the automatic glacier mapping method compare with manual method

	Area（m^2）	Area Error（m^2）	Area Error（%）	Perimeter（m）	Outline Error（m）
Manual	176130953			164269	
Ratio	173101843	-3029110	-1.72		-18.44
NDSI	175147905	-983048	-0.56		-5.98
Unsupervised	**176357338**	**226384**	**0.13**		**1.38**
Supervised	176402393	271440	0.15		1.65

Table 5 Glacier outline elevation of the three largest contiguous ice masses

	Year	1973	1992	2004	2009
A	MIN	5222	5221	5221	5224
	MAX	5862	5855	5863	5867
	MEAN	5529	5517	5532	5533
B	MIN	5268	5280	5290	5295
	MAX	5992	6010	6065	6007
	MEAN	5596	5611	5617	5617
C	MIN	5167	5200	5215	5218
	MAX	6111	6058	6135	6122
	MEAN	5581	5597	5606	5619

Table 6 Glacier Area in 6 basin (km^2)

Year	1973	1992	2004	2009
Total	1019.83	993.15	943.40	924.49
B1	378.57	367.23	352.30	348.41
B2	0.00	0.00	0.00	0.00
B3	221.34	217.49	200.15	193.48
B4	100.79	101.90	98.35	97.85
B5	149.03	146.68	140.33	138.99
B6	170.10	159.85	152.27	145.76

Table 7 Area of three lakes (m^2)

Year	1973	1992	2004	2009
L1	6525187	6531842	6683822	6574500
L2	4480120	4625764	4675717	4742100
L3	2028934	2107788	2076517	2147400

Fig:

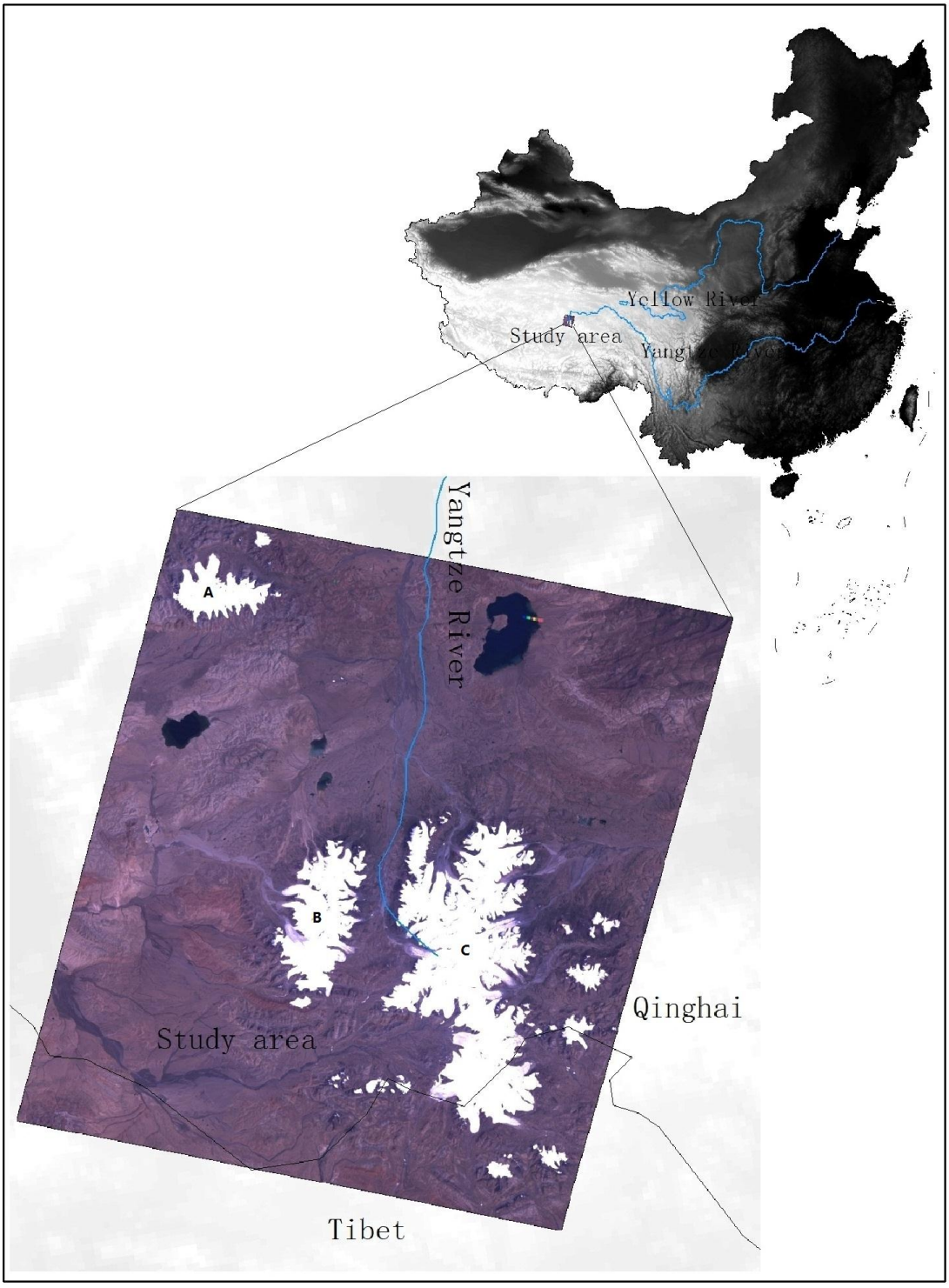

Fig.1 Geladandong Mountain location and Landsat TM image taken on 31 August 1992.

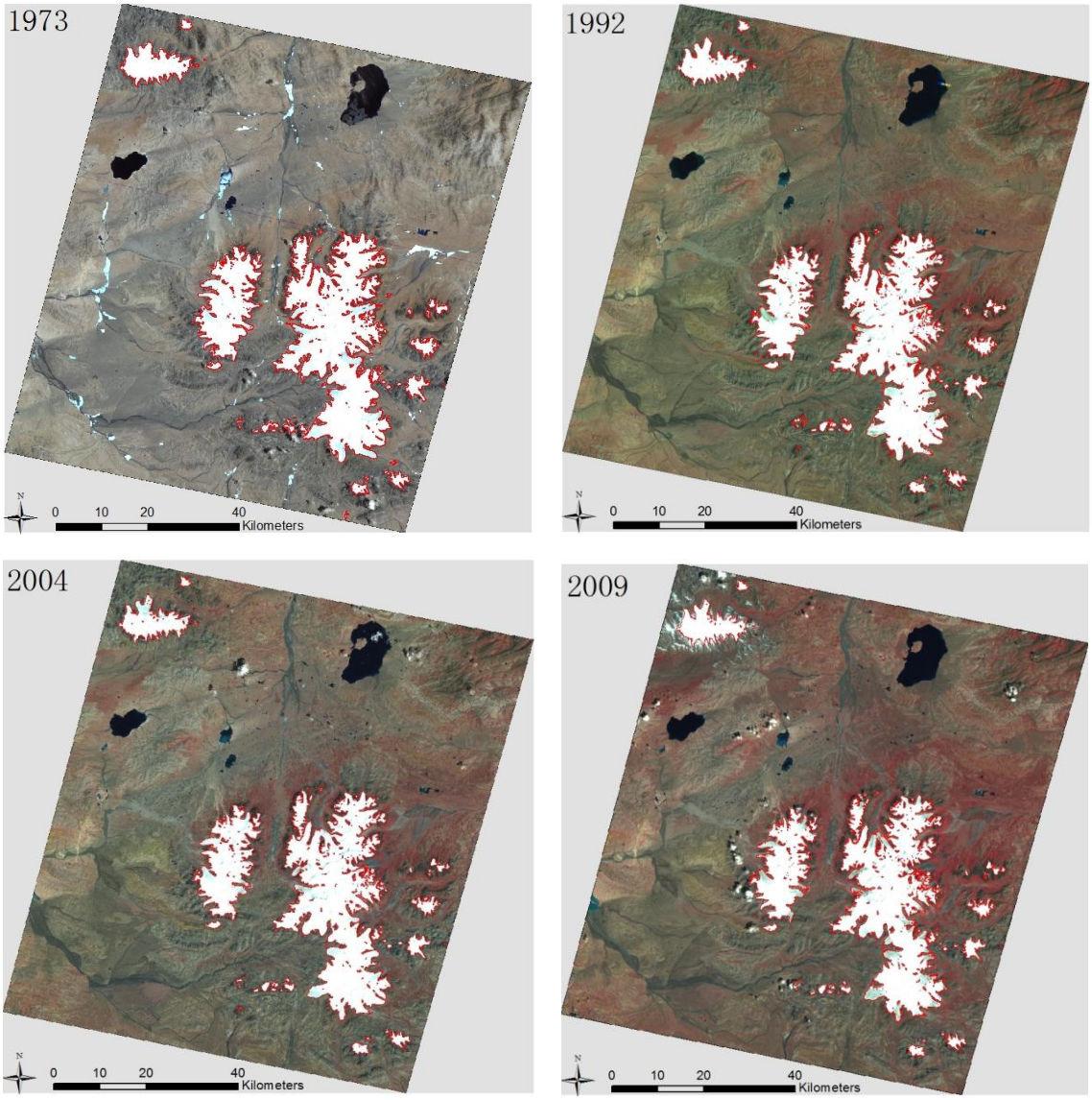

Fig. 2 Geladandong Mountain area glacier coverage surrounded by the red line for 1973, 1992, 2004 and 2011.

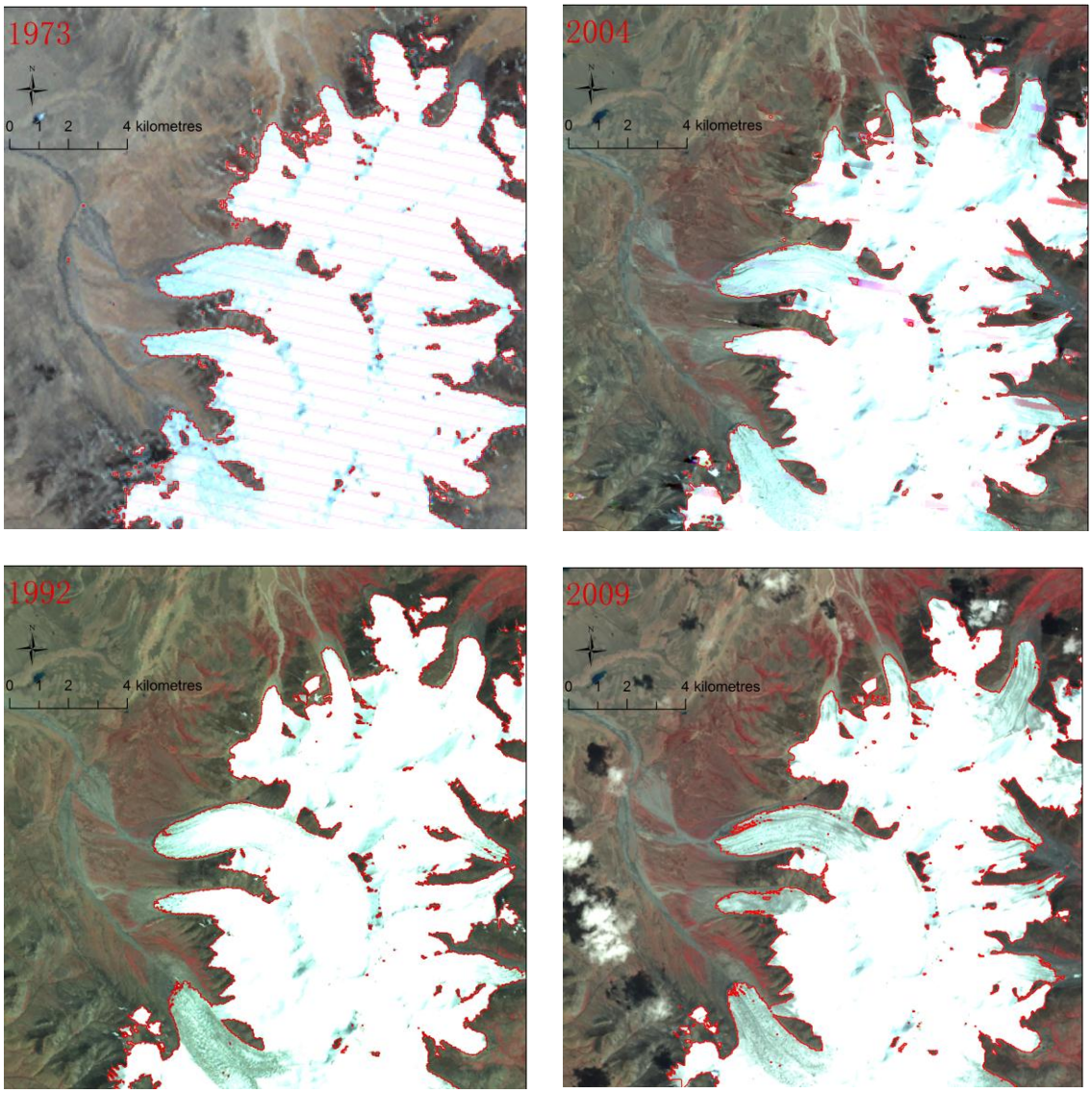

Fig.3 Geladandong Mountain area glacier coverage surrounded by the red line for 1973, 1992, 2004 and 2011.

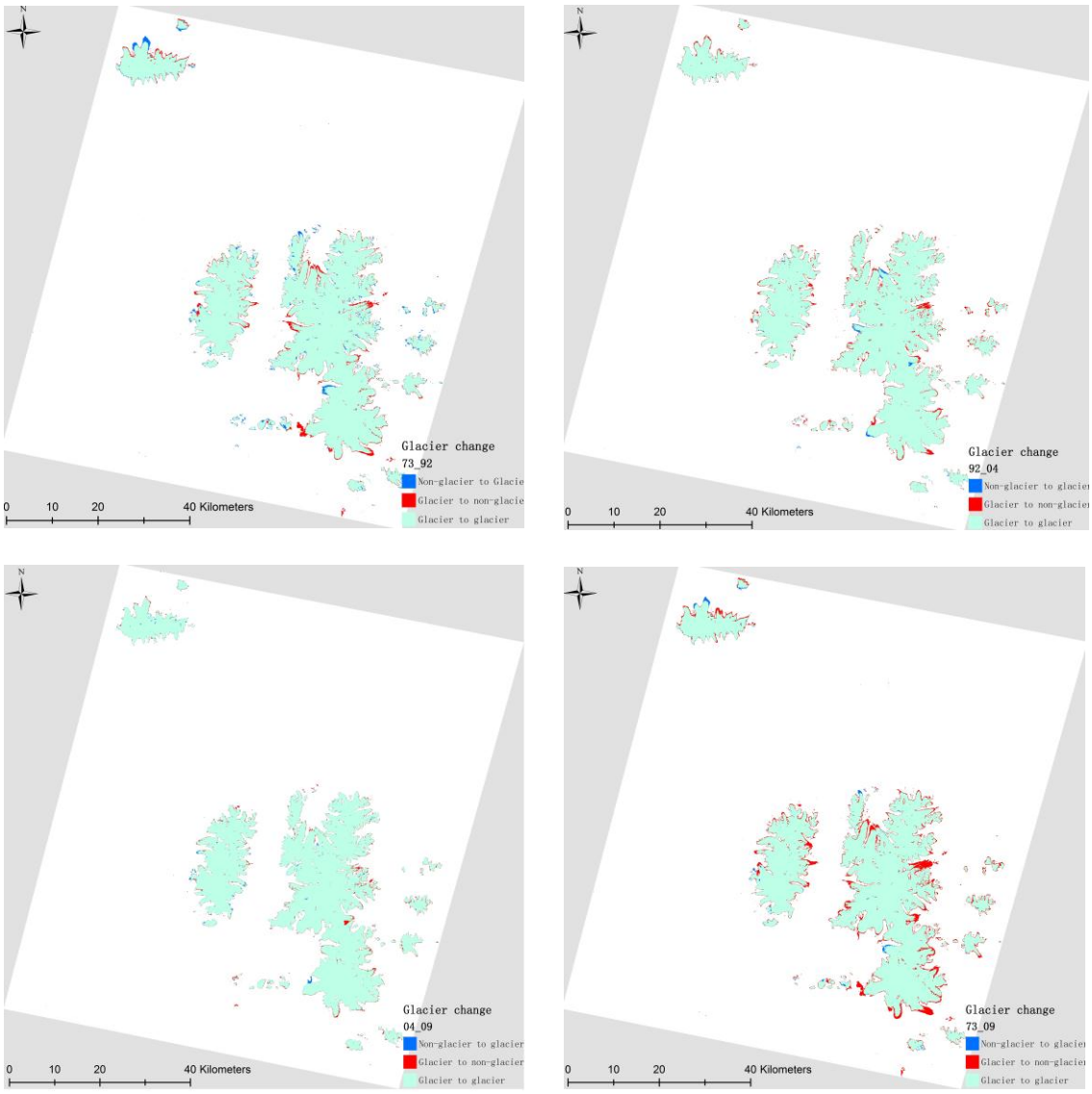

Fig. 4 Glacier change for 1973-1992, 1992-2004, 2004-2009 and 1973-2009 in the Geladandong Mountain area

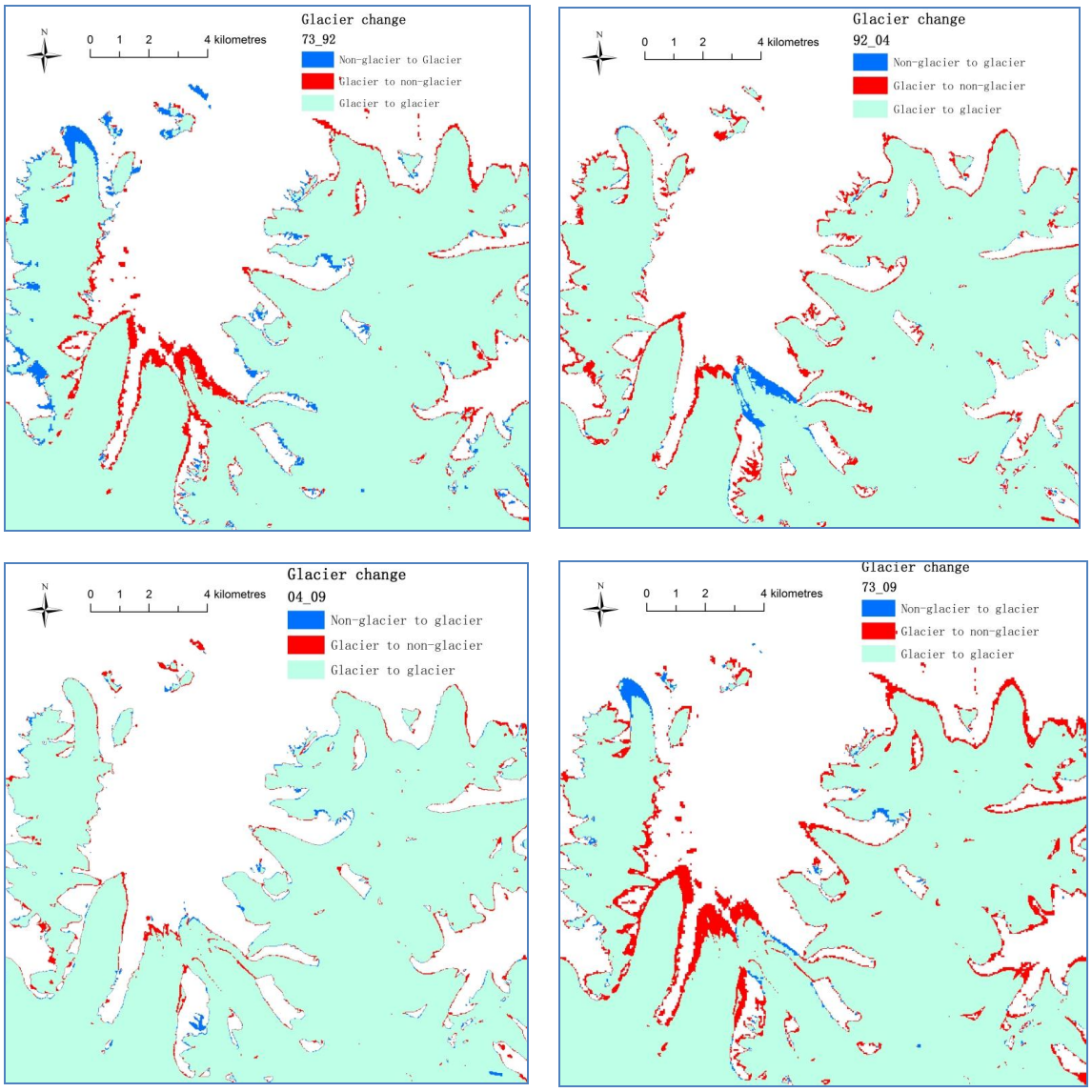

Fig. 5 Glacier change for 1973-1992, 1992-2004, 2004-2009 and 1973-2009 in the Geladandong Mountain area

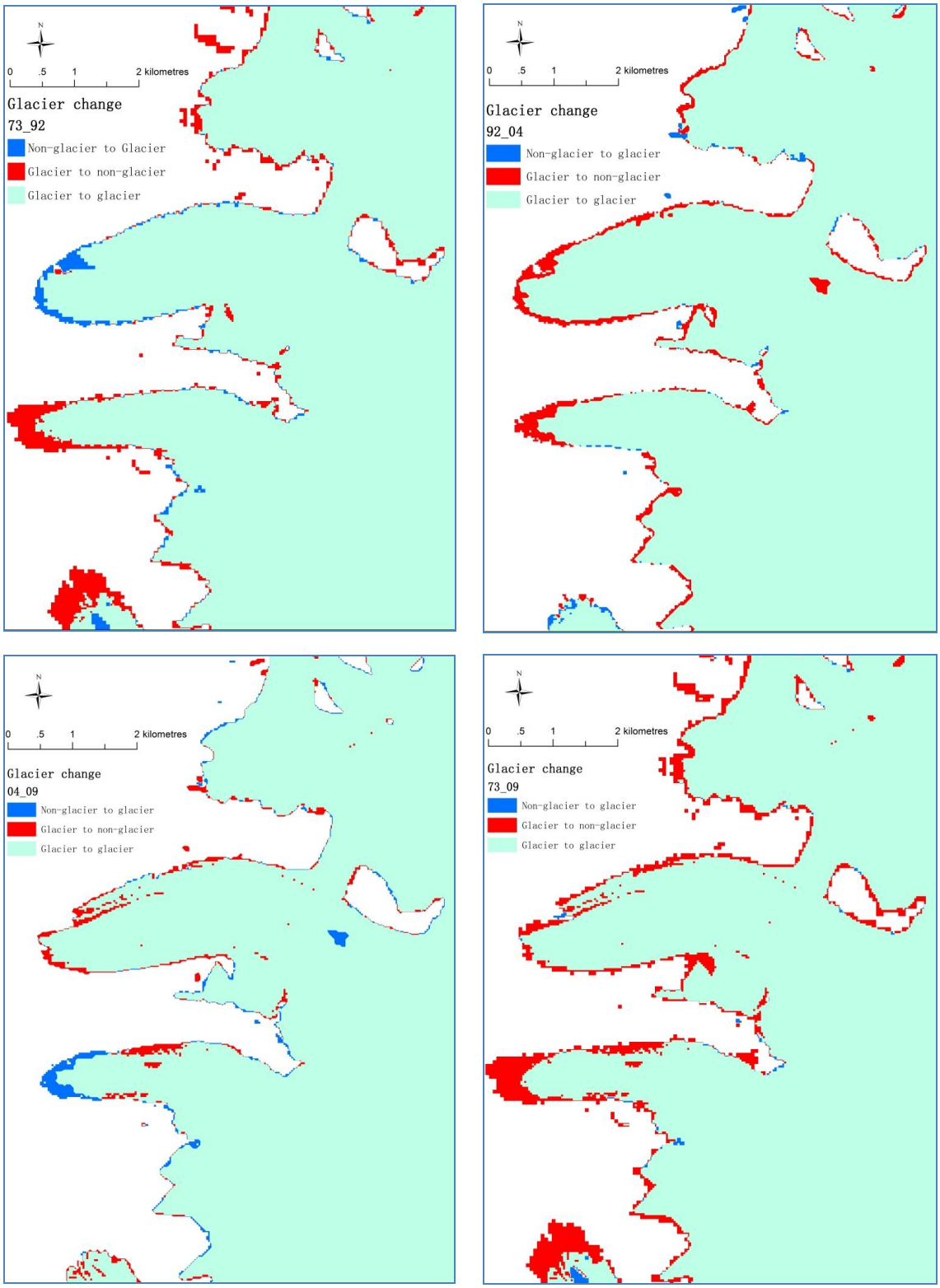

Fig. 6 Glacier change for 1973-1992, 1992-2004, 2004-2009 and 1973-2009 in the Geladandong Mountain area

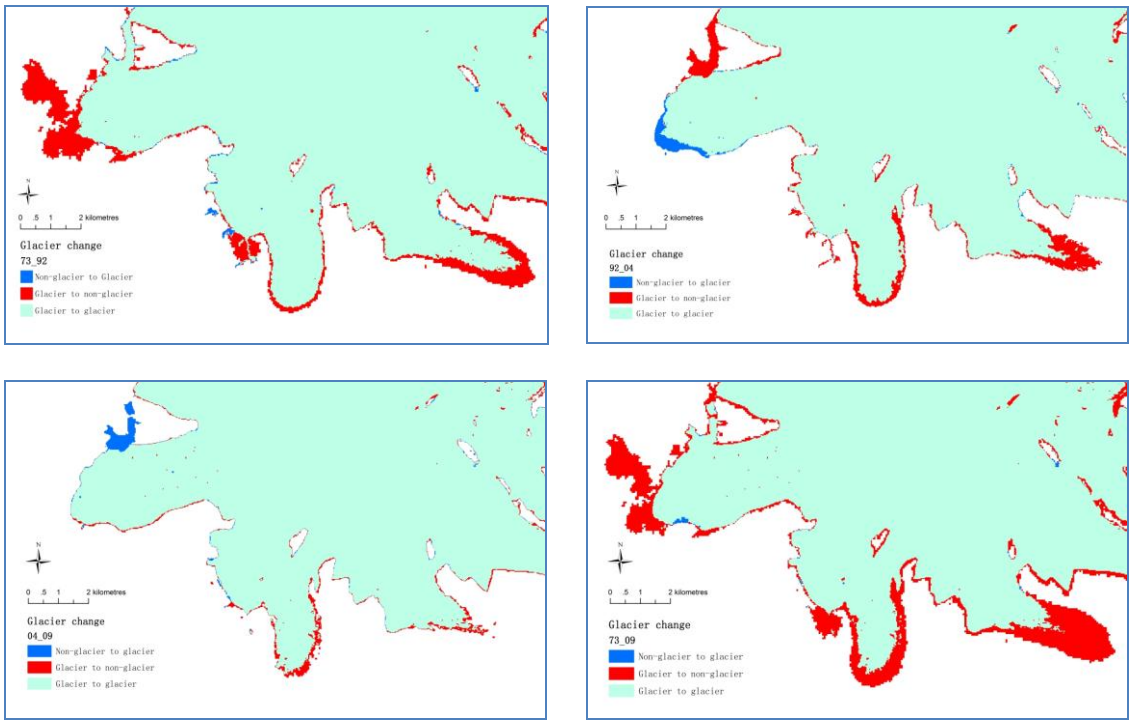

Fig. 7 Glacier change for 1973-1992, 1992-2004, 2004-2009 and 1973-2009 in the Geladandong Mountain area

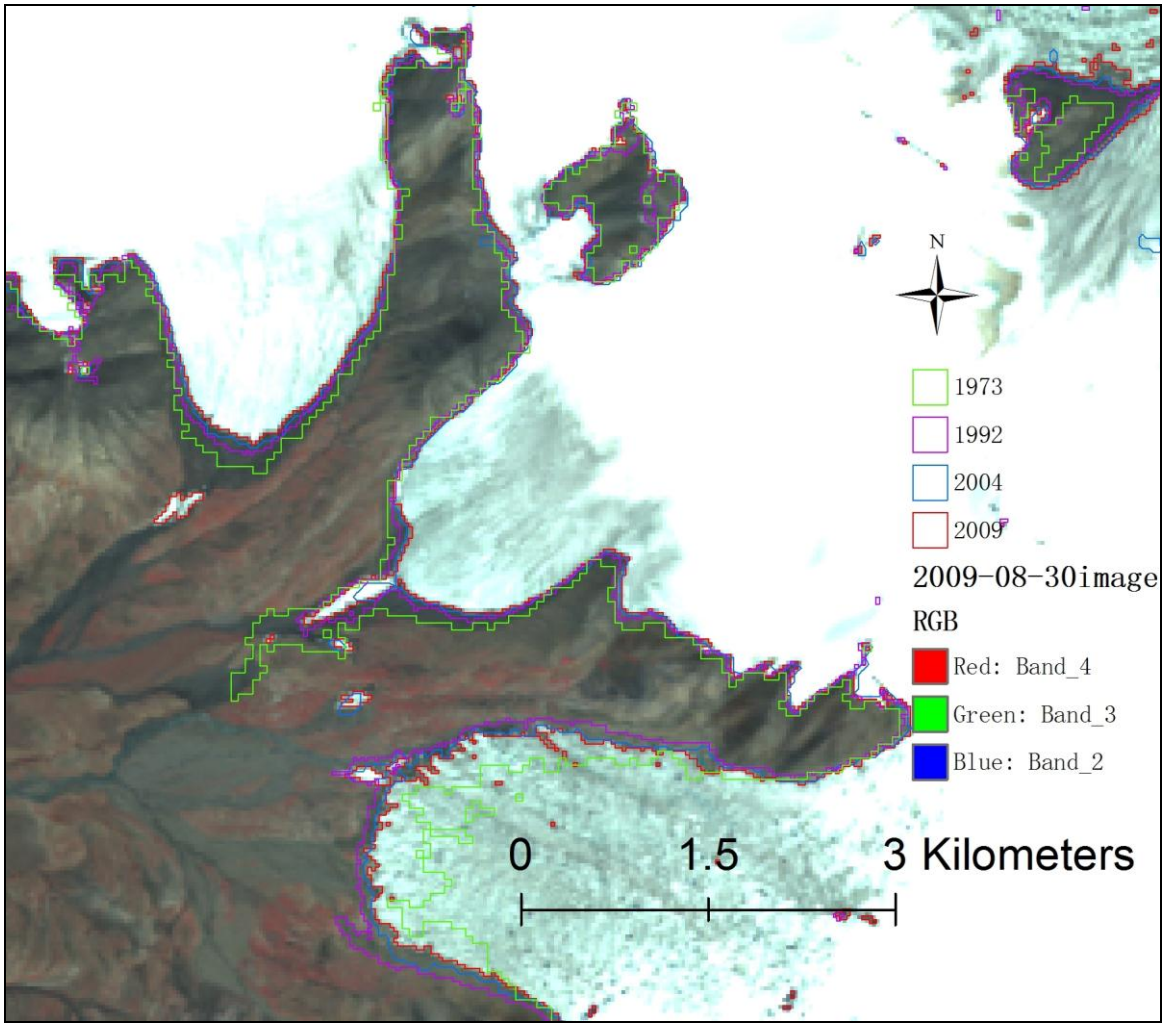

Fig. 8 Glacier outline for 1973, 1992, 2004 and 2009

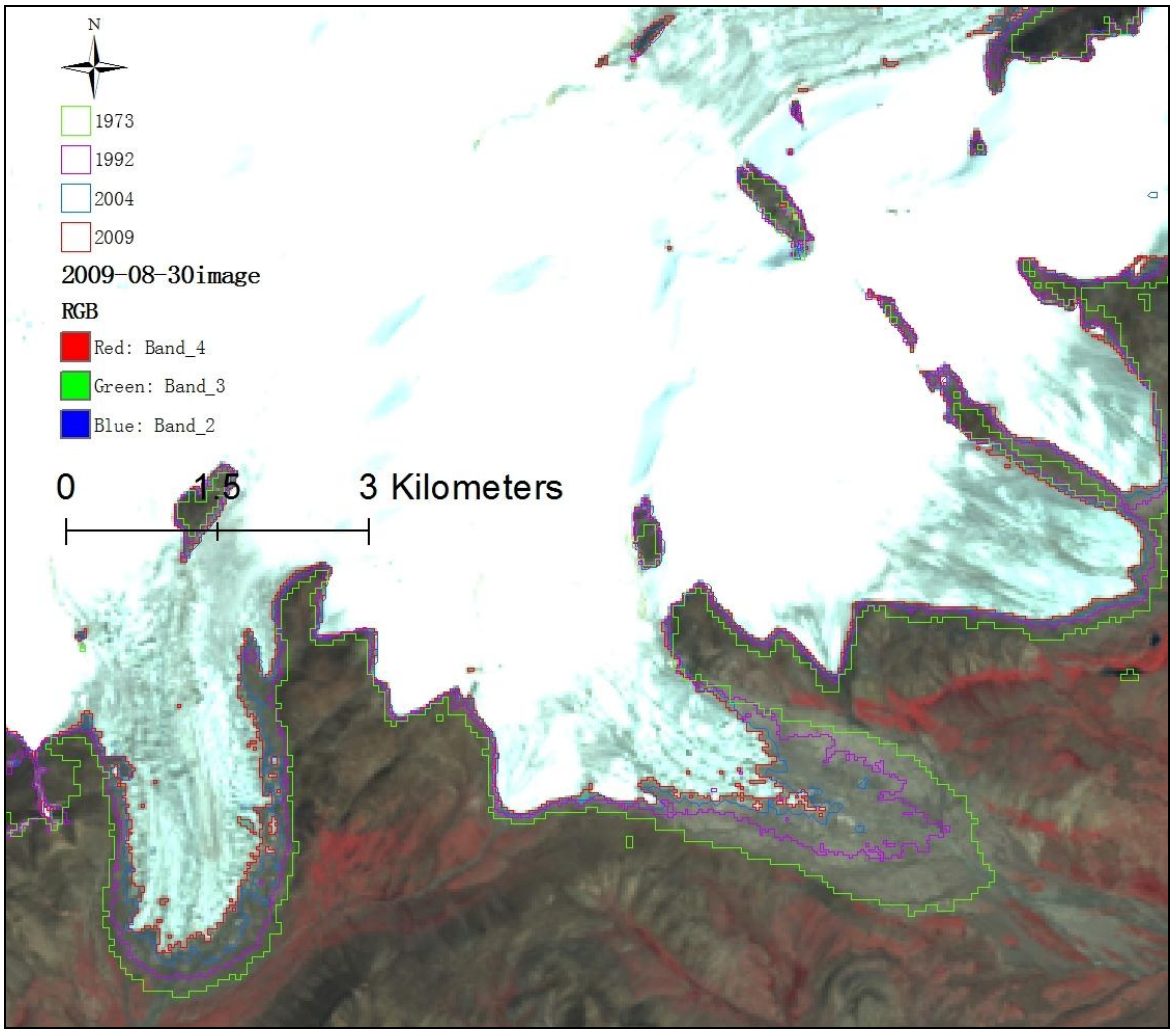

Fig. 9 Glacier outline for 1973, 1992, 2004 and 2009

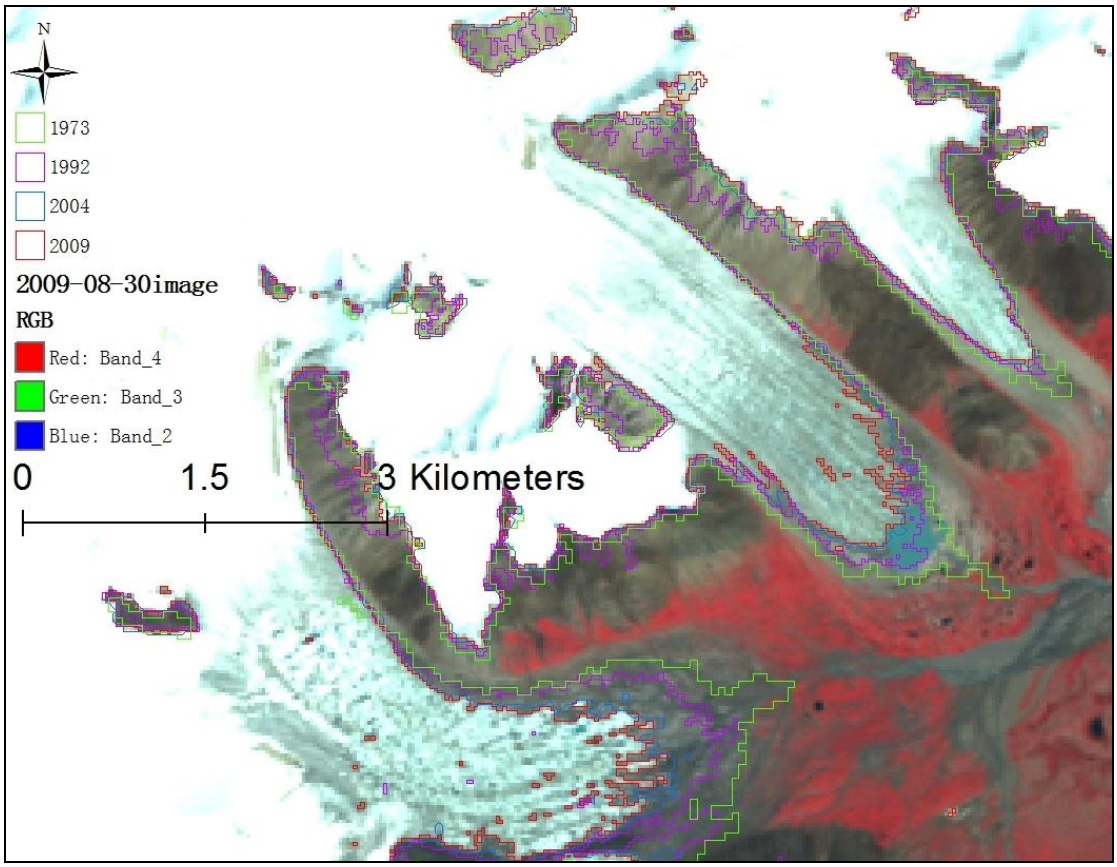

Fig. 10 Glacier outline for 1973, 1992, 2004 and 2009

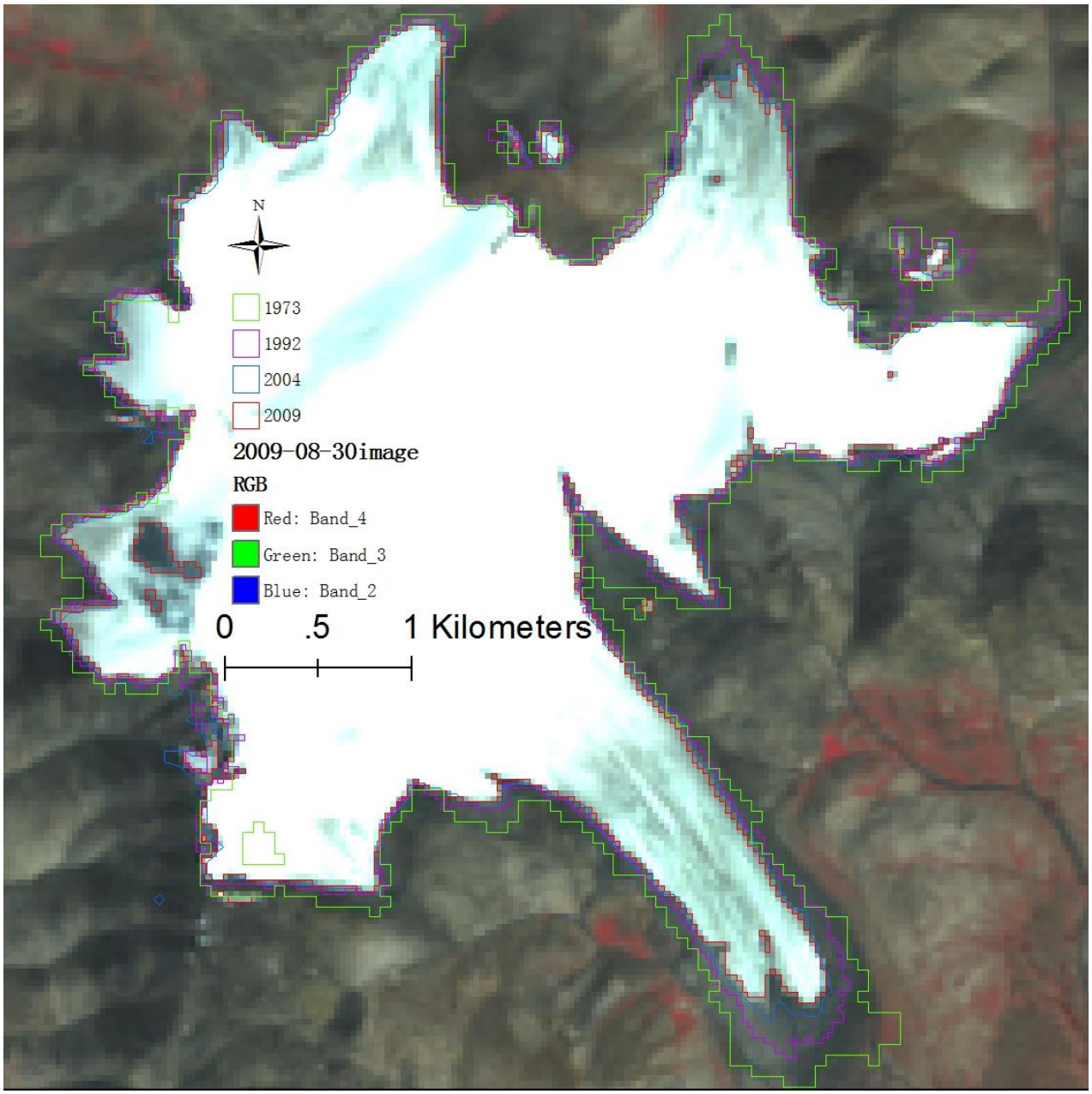

Fig. 11 Glacier outline for 1973, 1992, 2004 and 2009

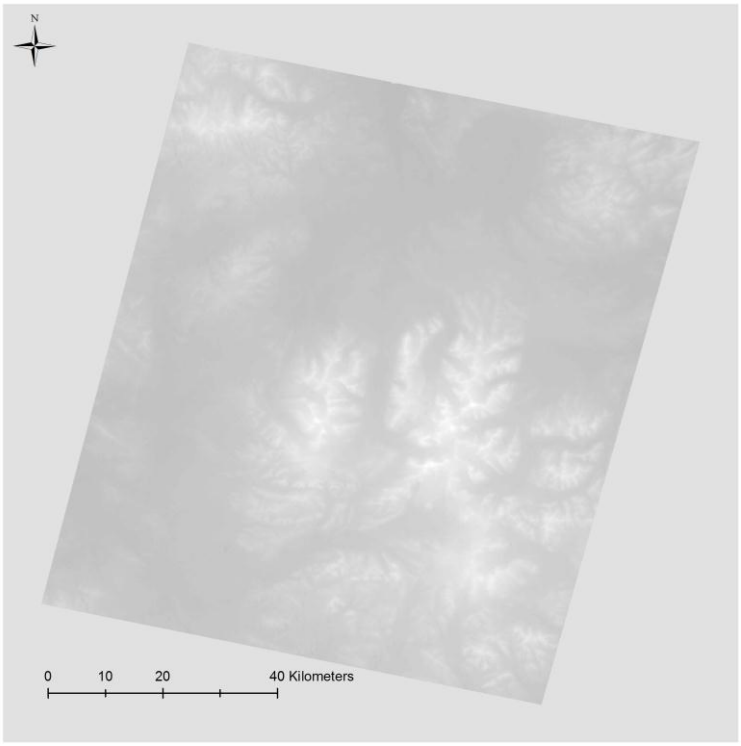

Fig. 12 The DEM of the study area

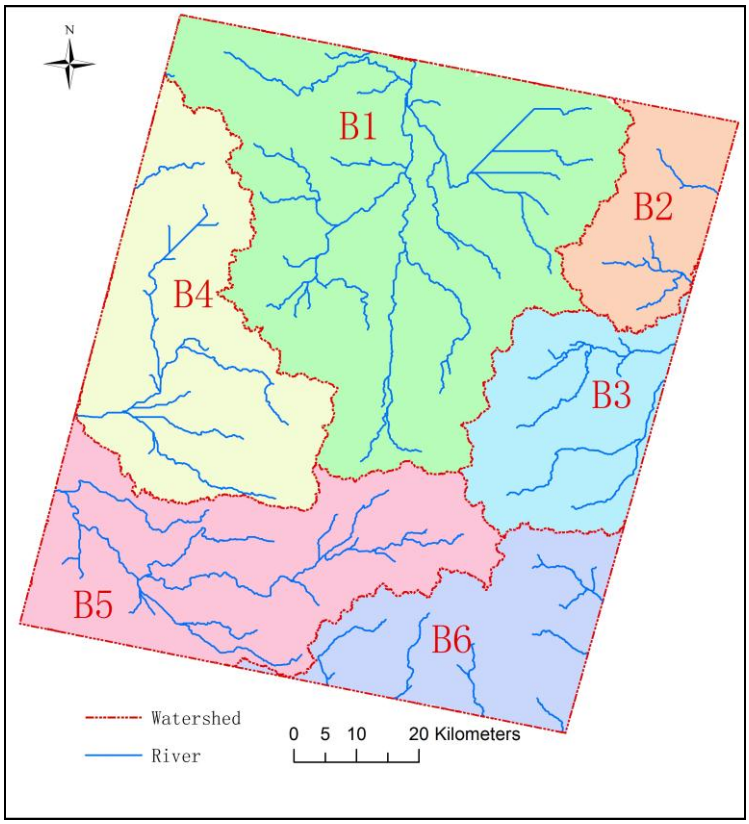

Fig.13 Drainage map of study area, the river in B1, B2 and B3 end into Yangtze River, the river in B4 and B5 end into Chibzhangcuo, and the river in B6 end into Selincuo.

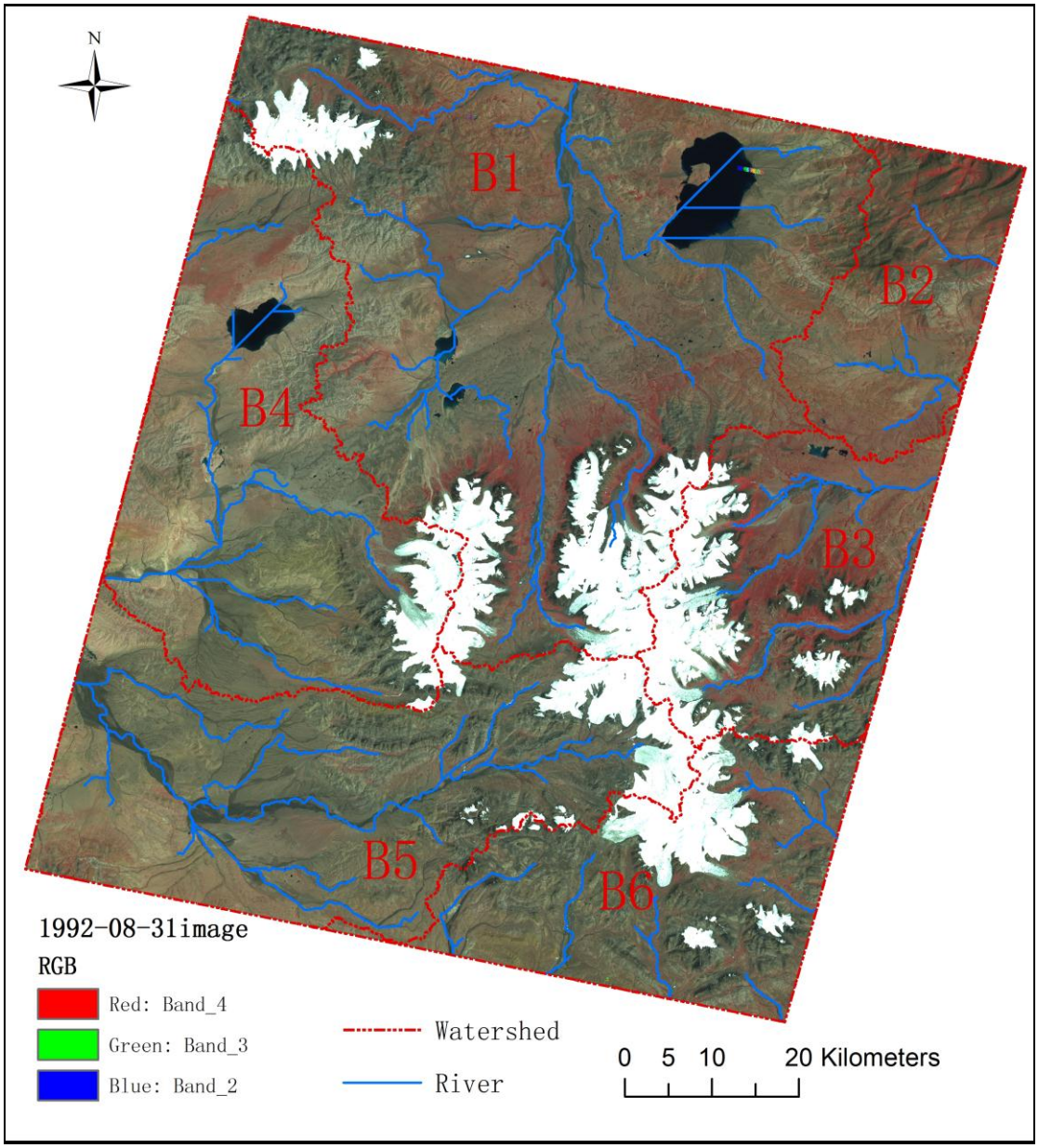

Fig.14 Drainage map of study area, the river in B1, B2 and B3 end into Yangtze River, the river in B4 and B5 end into Chibzhangcuo, and the river in B6 end into Selincuo.

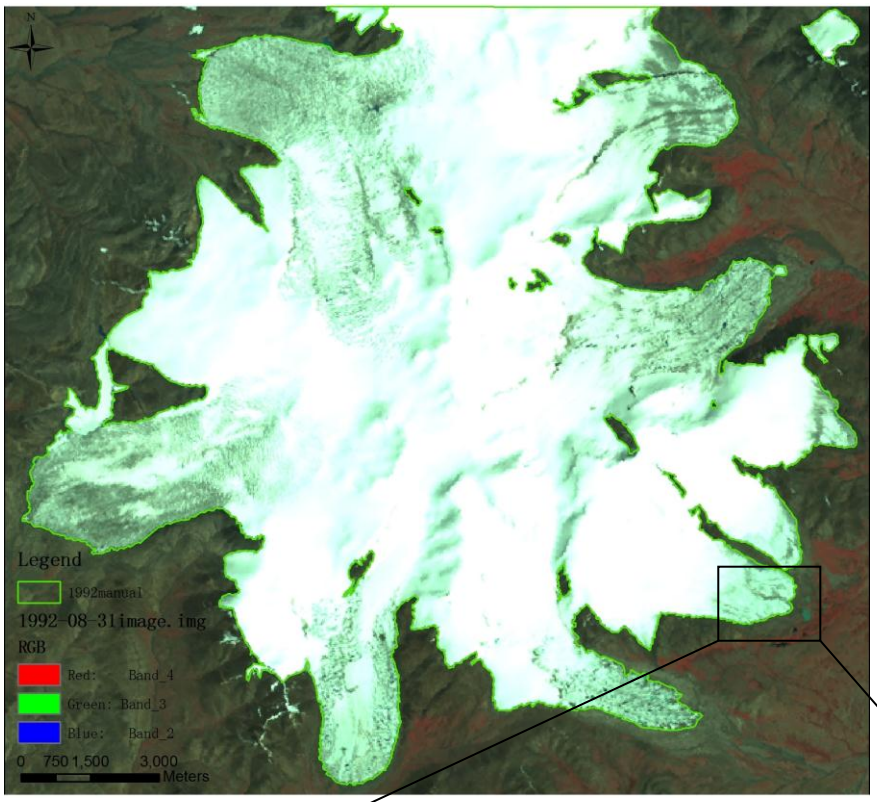

Fig.15 Selected area for comparing the precision of the 5 different glacier mapping methods.

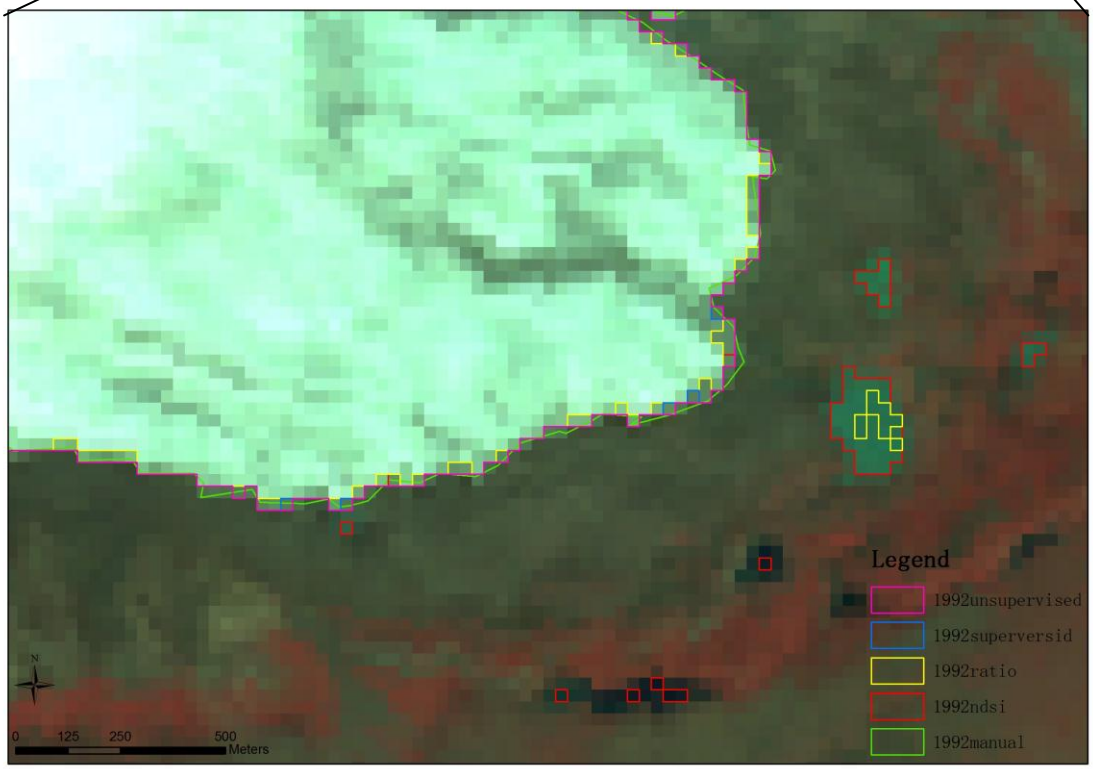

Fig.16 Glacier outline produced by 5 different glacier mapping methods.

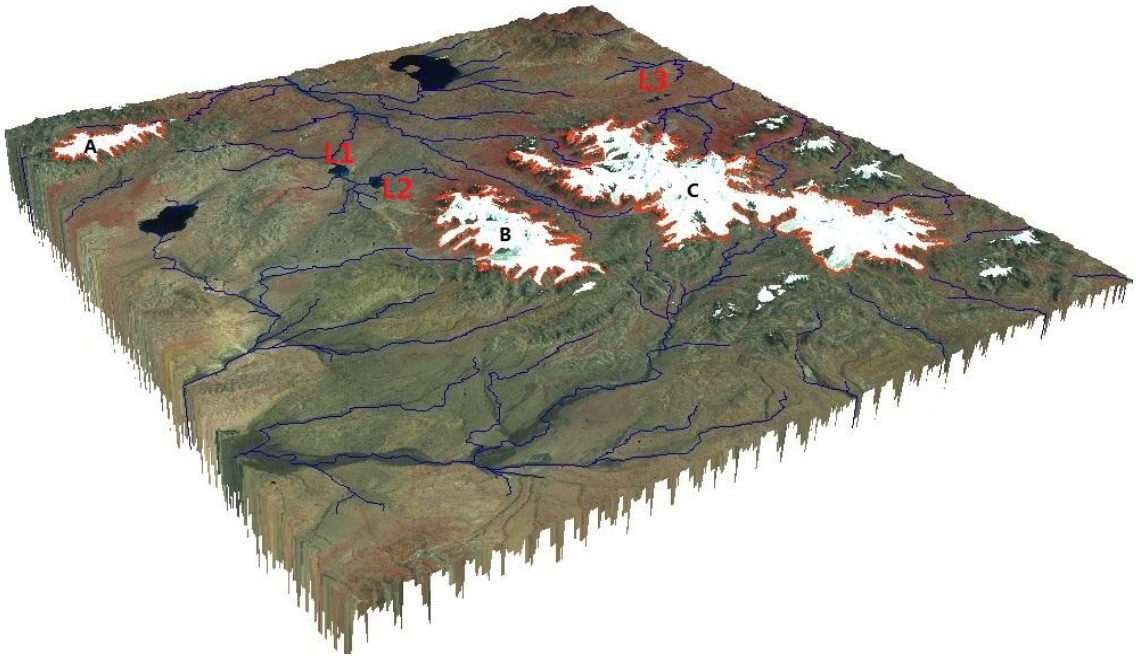

Fig17. The sites of the three lakes