

Status and vital role of glaciers at a glance

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ABSTRACT

A glacier is a thick ice mass that forms during more than hundreds or thousands of years. 15% freshwater of our planet belongs to glaciers (Valley or Ice sheet). Approximate 674734km² (except the main ice sheets of Antarctic and Greenland) worldwide area covered by glaciers (NSIDC2015). Since the second half of 19th century (1850), almost all glaciers are had been retreated. Glacier forms (originate) on high lands places where more snow falls each winter comparison than melts, each summer. Glaciers are in retreating status almost everywhere in the world including Alps, Andes, HKH, Rocky Mountains, Southern & Northern Hemispheres, Polar circles (Arctic & Antarctic, Greenland, Ice land, Canada), Tropical zone (Africa, South America, Oceania), North Europe, Siberia and the Russia Far the East. The formation and Regime of river basins flow, directly depend to the health of glaciers status. Availability of freshwater for domestic use, animals, plants and mountain recreations has crucial linkage to the status and health of glaciers also. Another a major concern related to retreat and melting of glaciers are increasing runoff glacial lake outburst floods (GLOFs). Glacier runoff highly important for Hydropower generation in same places also (for example in Central Asia, Norway, Pacific Northwest, North America, Alps etc.). Meanwhile seasonal glacier melt water for irrigation and safe drinking water supplies plays significant and vital role also. 2, 3 billion people living in the shared river basins of the developing world with a gross economic output of 10 Trillion US \$ per/year (Global High level Panel on Water & Peace, 16 November, 2015, Geneva).

Key words: Albedo, Asian Brown Cloud, Black Carbon, Cryosphere, Ice sheet, Valley glacier, Water balance, Water cycle.

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I. INTRODUCTION

Historically, 1500 years ago up to 30% of our planet was covered by glacial ice. Today glaciers still cover nearly 10% of Earth's land area (Tar buck & Lutgens 2006). Worldwide an estimated 16000 glaciers covering almost 15 million Square Kilometers. Almost 3% of worldwide glaciers located in the mountains of Asia, Europe, and America (ICIMOD 2011). Based on some Scientists attributions during industrial revolution which began around 1760, glaciers worldwide have been retreated at unprecedented rates, but since 1850 glaciers have retreated obviously everywhere including Europe, Siberian and the Russia Far East, America, Canadian Rockies mountain, Alaska, South Hemisphere, Oceania, Central Asia, and Hindukush- Himalaya-Karakoram (HKKH) ranges. Du to anthropogenic and human activities up to 200 last year's heat-trapping gases (GHG) with high velocity emitted through Atmosphere and accelerated glacier disappearing day by day. The World Glacier Monitoring Service (WGMS) report in 2005, Noted: 115 of 115 glaciers examined in Switzerland, and the same quantity in Austria retreated. In Italy, 50 glaciers have retreated and all 7 glaciers observed in France were in retreat. This pattern is available as a trend worldwide. Glaciers in North Everest region of the Himalayas are all in a state of retreat. The most famous of this, the Khumbu glacier retreated at a rate of 18m/yr., from 1976-2007 (ICIMOD January 10, 2010). Cryosphere changes over time show a considerable increase in surface temperature, decline in Sea Ice area, Permafrost depth and glacial mass balance. These are decisive indicators of obvious and significant changes, that effect on cryosphere and glaciers status. Mountain regions highly at risk due to glaciers melting. For example, more than hundred million people in South Asian populated countries are at risk from glacier melting.

Types of glaciers likewise, surface (running) water, underground water, waves and wind, glaciers are also a dynamic agent of erosion. Glaciers are transporting, accumulate and deposit sediments. Thus, they are an important integral part of the rock cycle. Commonly there are exist two types of glaciers:

A: Valley Glaciers Valley glacier can be short or long, wider or narrow, single or with branching tributaries. Thousands of small glaciers exist in high mountain ranges worldwide. This type of glacier like a stream of ice that flows between steep rock walls from near place of the top mountain valley.

B: Ice sheets Enormous ice masses that flow in all directions from one or more centers, call ice sheets (continental ice sheet). They cover everything but the highest land. Comparison to valley glaciers they are huge. Ice sheets of Arctic (Greenland) and the Antarctic both are covers almost 10% of Earth's land area. Almost 80%

of green- land captured by one ice sheet. The thickness of them 1500 meters and in some parts it rises to 3000meters above the ice land’s surface. In southern hemisphere (Antarctic) ice sheets thickness rise to 4300meters. It holds almost two-thirds of world fresh water. Sea level will be rise 60-70 meters if ice sheets melted and coastal cities would flood (Tar buck. Lutgens 2006). Deference (Mass balance) between sublimation or melting and accumulation of glacier has crucial linkage to its survival.

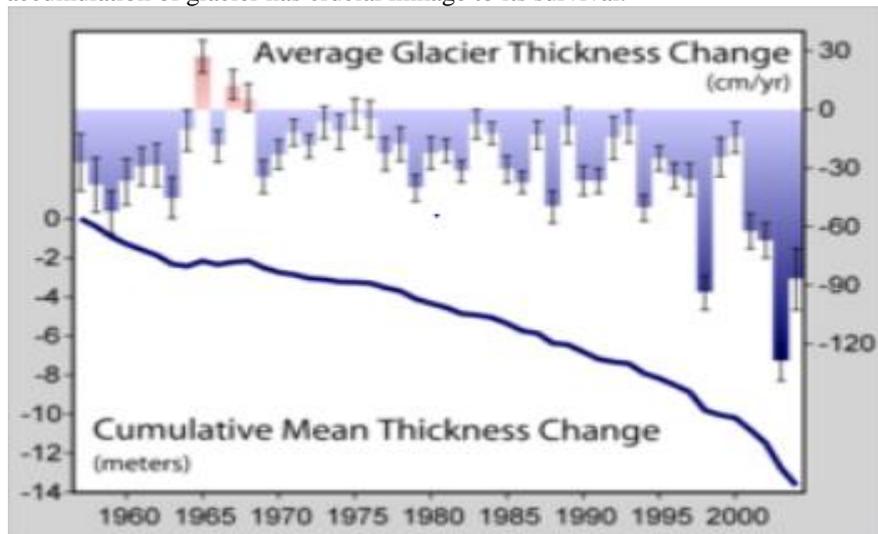


Figure1. Global glacial mass balance in the last fifty years (WGMS & NSIDC)

Average Cumulative Mass Balance (ACMB) of “reference” glacier worldwide, 1945-2015 shown in below diagrams. In this diagram, the upper graph characterized the number of measured glaciers and negative values show a net loss of ice snow compared with the year 1945.

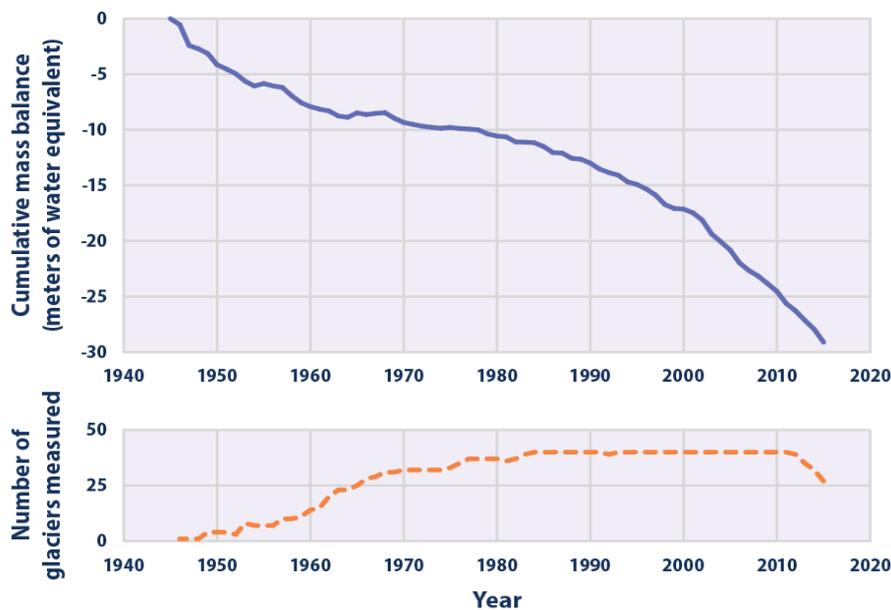


Figure 2. Average Cumulative Mass Balance (ACMB) of “reference” glaciers worldwide, 1945-2015 (EPA Web Archive on the January 19, 2017 Web Snapshot).

UNEP warning on glaciers

- The live and future of hundred million people in the world will be affected by decreasing (reduction) in snow cover, Sea ice, glaciers, lake ice and permafrost (An UNEP report launched on World Environment Day on 14 June Said).
- An estimated 40 percent of the world population could be affected by the loss of snow cover and glaciers in the mountains Asia (Said UNEP in the report, global out look for ice and snow).

- Due to global warming and change in temperature has led to melting, formation, and expansion of glacial lake outburst floods (GLOFs). Mountain regions at risk likewise Himalaya, Tien Shan, Pamir, European Alps and the Andes (The UNEP report added).

Glacier retreating and its effects

An estimated 15000 glaciers can be found in the greater Himalayas, with double that number in the Hindukush and Karakoram including Tien Shan ranges. These glaciers produce available (critical) supplies of water for arid-semiarid countries like Afghanistan, Pakistan, India, Western China, and Mongolia.



Figure 3. Gangotri glacier in the Uttarkashi District of Garhwali Himalaya (NASA)

Blue contour line shows the regression of Gangotri glacier over time. Recently this glacier as the largest one has (0, 5 -2, 5) km wide and 30, 2 km long. Garmo Glacier (Pamir Tajikistan) from 1932 to 2005, 7 kilometer retreated.



Figure 4. Garmo Glacier Degradation (NASA).

In Afghanistan (1952) glaciers area was 4240 km², by 1985 it retreated (degraded) for 1000km² and at present glaciation degradations exceed 50 percent. Between 1976-2003 years in the WA khan corridor of Afghanistan 28 to 30 glaciers examined retreated significantly with an average of 11 meter per year. In India, the Gangotri glacier retreated 1147 meter “between 1936 - 1996”. Overall, glaciers in the Himalayan region have been studied are retreated an average of (18- 20) meter annually and consequently, a number of glacial lakes have been created. In 1944 a GLOF from LuggyeTsso, a glacial lake killed 23 people in downstream. Glaciers in

AK-Shirak range in Kyrgyzstan, in the Pamir Mountains in Tajikistan (Fedchenko glacier), have also retreated. The recent GLIMS project examined ASTER and Landsat MSS data 1976-2003, in the WA khan Corridor of Afghanistan.

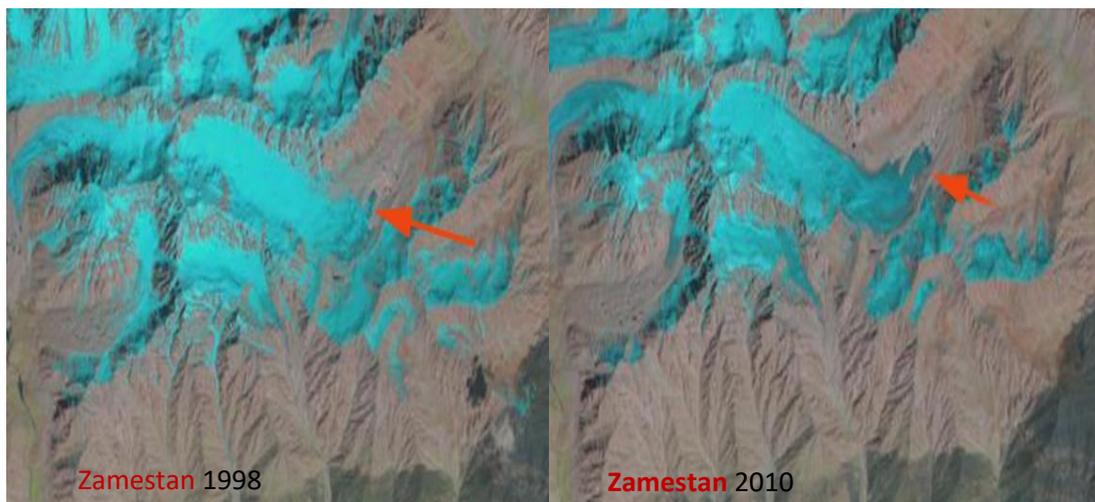


Figure 5. Comparison Zamestan glacier among 1998 - 2010
(<https://glacierschange.fies.wordpress.com/2009/12/zmestan-1981-2010.ipg>).

Of the 30 alpine glaciers varying type, size and orientation examined 28 glaciers- terminus Position has retreated. Zamestan glacier has retreated a rate of 17m/y during 1998-2010 (Umesh Haritashaya et al, 2009). Significant loss of glaciers in central Asia began around the 1930s, become more dramatic in the second of the 21st century. Between 1943-1977 the AK-Shirak range Glaciers in Kyrgyzstan also experienced a slight loss, but this retreating accelerated 20% loss of their remaining mass from 1977 to 2001. The Tien Shan's mountain range Glaciers (in the northern part) that help water supply for arid areas (Kyrgyzstan, China and Kazakhstan), lost almost 2km³ its ice p/y between (1955- 2000) years (Kirby, Alex, 2003).

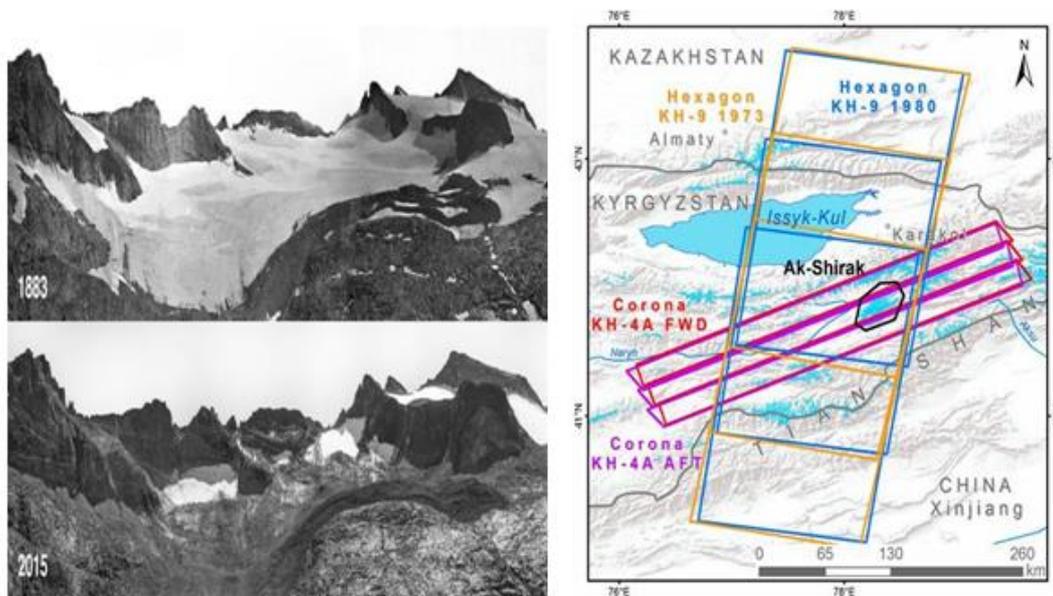


Fig 6. Comparison retreating the AK-Shirak Glacier between 1883-2015 (Bing.com/images).

Glaciers in the Pamir high mountains, supply water to over 60 million people in Afghanistan, Tajikistan, Uzbekistan, Turkmenistan and Xinjian province of China. Many of the remained worldwide glaciers are also under the pressure of retreat due to population growth, urbanization, industrialization, increasing emitted GHGs, Black Carbone release, during the past century caused by global warming phenomenon. The mean retreated effects of glaciers as per follow:

- Continued regression of glaciers are heavily affected on reduction or runoff water flow, its formation and downstream flooding.
- Reduction in runoff affects the ability to irrigate crops, the inefficiency of summer flows necessary to keep dams and reservoirs replenished.
- Food, water, and hydropower energy production directly depend to the health of glaciers (e.g., Central Asia countries, Norway, Alp's, Pacific Northwest, North America, etc. more related to Hydropower energy).
- Seasonal glacier melt water for irrigation and drinking supplies plays a significant role.
- IPCC, 2007- estimate: Antarctic & Greenland both are contributing 0,5mm a year each to global Sea Level Rise.
- Many species of freshwater and saltwater animals significantly depend on the glacier -feed waters (US EPA, 2017).

Flood and flood control Strategies

While the discharge of a stream so great, thus it exceeds the capacity of its channel and overflows it is banks, a flood occurs. Most floods are caused by rapid spring snowmelt or storms that bring heavy rains over a large quantity (flow regime). Several factors influencing (caused) flash flood, likewise rainfall intensity and its duration, surface conditions and meanwhile the topography of lands. Flood control strategies require Artificial Levees, Flood control Dams, and planning limits on floodplain development.



Figure 6. The aftermath of the debris flow in Punjsher Province, Afghanistan 11 July 2018 (at night). In this event 500 houses demolished and around 10 person were disappeared

Conclusion and needed policy options

- Requiring the use of clean fuels.
- Requiring properly filtering technologies.
- Limited /provide high-temperature combustions (Supercritical coal for existing power generation plants).
- Regulating annual emissions from power generation plants.
- Banning the use of low-quality fossil fuels.
- Limiting the use of chimneys and other forms of biomass burning in urban and rural areas.
- Regulating /banning the sale of certain fuels.
- Shift fossil fuels to compressed natural gas.
- Eliminate/limited emission of Black Carbone as the second strongest contribution to current global warming after CO₂ emission.
- Eliminate residential biofuel burned with traditional devices.
- Related to Hindukush-Himalaya-Karakorum region (Largest quantities of glaciers after poles circles) eliminate/bane the causes composition of the Asian Brown Cloud (ABC).

- The Worldwide policy against the trend of global warming and serious attentions to implemented the Kyoto Protocol principals including amendments.

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