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A DECADE OF CHANGING CLIMATE ON VESTRE BROGGERBREEN GLACIER, NY-ÅLESUND, SVALBARD, ARCTIC

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Abstract

Deglaciation in high mountain areas is occurring at an alarming rate, particularly in the arctic region. The soaring rates of deglaciation concern climate scientists worldwide. During the recent past, changes in glaciers are the most sensitive proxy for global climatic variations. It is crucial to understand how northern polar ice masses respond to climate change with more than 60 percent of the Svalbard archipelago covered by glaciers and icecaps. In the last couple of decades, several Svalbard glaciers have been measured annually for mass balance. (Hagen et al., 2005) reported a negative mean net balance overall. Vestre Broggerbreen Glacier (VB), Ny-Ålesund, Svalbard, Arctic, has been monitored by Geological Survey of India since 2008. The observations carried out during the last decade are presented in this paper. VB is approximately 10 km west of Ny-Ålesund. A stream of melt water flowing from the VB glacier and the adjacent Austre Broggerbreen glacier drains into the Kongsfjorden via the Bayelva stream. VB glacier in Ny-Ålesund lies between latitudes 78°53.4’ N to 78°55.3’ N, and 11°38.9’ E to 11°47’ E, and covers an area of 4.62 square kilometres. A glacier can be found at altitudes between 50 and 550 meters. Equilibrium Line Altitude occurs at 350 meters above sea level. SMB is calculated by measuring the amount of snow and ice melted during the summer, and the amount that is left after the melting season. Mass balance is the difference between these two parameters. Based on the contour interval, the VB glacier is divided into different altitudinal zones of 50 m. Since 2011, VB glacier has recorded negative SMB (about -0.0002197 metric ton water equivalent

in 2017-18). SMB was slightly positive during 2014-15 and 2015-16, presumably due to the shorter warm period. From 2011 to 2018, the VB snout receded about 150 m. On the snout and near the ELA, several transverse crevasses are mapped. The gradient of the glacier from accumulation zone to the snout clearly reveals that the sudden change of the gradient in bedrock configuration below the glacial ice has resulted in differential velocity leading to development of crevasses. A shear stress map of the VB glacier has also been prepared. Variation in thickness of the VB glacier has also been measured using Ground Penetrating Radar (GPR). Glacier flow is a combination of the deformation of the ice sliding of ice over its bed. Glacier velocity therefore equals deformation plus basal melting. Average Surface velocity of VB varies from 5.0 my^{-1} to 0.5 my^{-1}. The continuous recessionary trend over VB glacier during the past decade is conformable with the current recessionary trend in the northern polar region. The net ice mass of the Arctic region shows decreasing trend (Jania and Hagen, 1996; Dyurgerov and Meier, 1997; Dowdeswell and Hagen, 2004; Kohler et al., 2007; Dowdeswell et al., 2008). The overall total net balance is negative, -4.5 ± 1 km^3 yr^{-1} over the archipelago. The variations in the annual measurements may be attributed to several factors like local weather/climate, summer and winter duration, wind pattern, changes in solar radiation, contribution of radioactive heat from the bedrock, thermohaline circulation, etc.

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DEVELOPMENTS IN SATELLITE REMOTE SENSING AND GIS FOR SOLVING SOCIO-ENVIRONMENTAL PROBLEMS IN 21ST CENTURY

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Introduction. The world today is grappling with myriads of socio-environmental challenges, many of which are exacerbated by anthropogenic climate change. However, the science and technology has provided many tools and resources to deal with these challenges which, some people will consider, have originated because of unregulated/unethical use of scientific developments. One of the most coveted scientific advancements relate to the employment of data from space-borne instruments. This discipline popularly