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Simulation of mass balance of glaciers in the Parlung Zangbo Basin in southeast Tibet from 1980 to 2019

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The Parlung Zangbo Basin, located in the southeastern Tibetan Plateau, where the marine glaciers are most concentrated. However, due to global climate warming over recent years, these glaciers have experienced substantial losses. By applying the Open Global Glacier Model (OGGM), we simulated the mass balance of 1,554 glaciers within the basin from 1980 to 2019. The results show that the mass balance of the entire Parlung Zangbo Basin was in a continuous state of loss from 1980 to 2019, with a rate of $-0.41\text{ m w.e. a}^{-1}$. The loss was even more severe in 2000-2019, reaching $-0.56\text{ m w.e. a}^{-1}$. Spatially, the southeast and northwest parts of the basin suffer from the most severe glacier losses, while the central and western parts have relatively less. The main causes of glacier mass loss are the increase in temperature and a slight decrease in precipitation. Through sensitivity analysis of temperature and precipitation, it was found that when the temperature rises by 1°C , the mass balance of 71.75% of the glaciers in the basin changes at a rate of -1000 to $-500\text{ mm w.e. a}^{-1}$. When precipitation decreases by 20%, the mass balance of 62.81% of the glaciers changes at a rate of -450 to $-300\text{ mm w.e. a}^{-1}$. Compared to precipitation, glaciers are more sensitive to changes in temperature. Meteorological data analysis from the National Meteorological Station and reanalysis data showed that the temperature increased by more than 1.5°C from 1980 to 2019. Total precipitation at the Bomi Station from 2000 to 2019 was 10% lower than in the previous 20 years, and the overall precipitation in the basin showed a decreasing trend. The ongoing rise in temperature, coupled with a marginal decline in precipitation, has resulted in sustained glacier mass reduction in the Parlung Zangbo Basin.