Tephra, mass- and energy balance: the influence of the Eyjafjallajökull eruption 2010 on Icelandic ice caps

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During the eruption in the subglacial Eyjafjallajökull volcano 14 April to 22 May 2010, tephra was blown over all the major ice caps in Iceland. After the eruption, a thick insulating ash layer covered most of the Eyjafjllajökull ice cap and large part of the Mýrdalsjökull ice cap. In contrast, most of the surfaces of the three largest ice caps in Iceland (Vatnajökull, Hofsjökull and Langjökull) were covered with a thin non-insulating thephra layer. The mass balance has been observed at 40–50 location of stakes on Vatnajökull since 1992 and at 22–23 stakes on Langjökull since 1996. The mass balance observations have been supplemented with automatic weather stations (AWSs) at 2–10 locations on Vatnajökull since 1994 and 2–3 stations on Langjökull since 2001, observing during the summers at 10 minutes interval all the weather parameters needed to calculate the surface energy balance. We present the mass- and energy balance observations on Langjökull and Vatnajökull during the exceptional circumstances 2010. The results are compared to the more climatically driven mass- and energy balance of the years 1992–2009. The results show that the tephra highly reduced the albedo of Langjökull and Vatnajökull, and significantly magnified the melting within the accumulation areas where up to three years of accumulation was melted away. The specific balance was -2.8 m a^{-1} w.e. on Langjökull in 2010, or more than twofold the average loss of -1.3 m a^{-1} w.e. of the warm years 1996–2009. For Vatnajökull, the specific balance was -2.1 m a^{-1} w.e. in 2010, also more than two times the average loss of -0.8 m a^{-1} w.e. from 1996–2009.