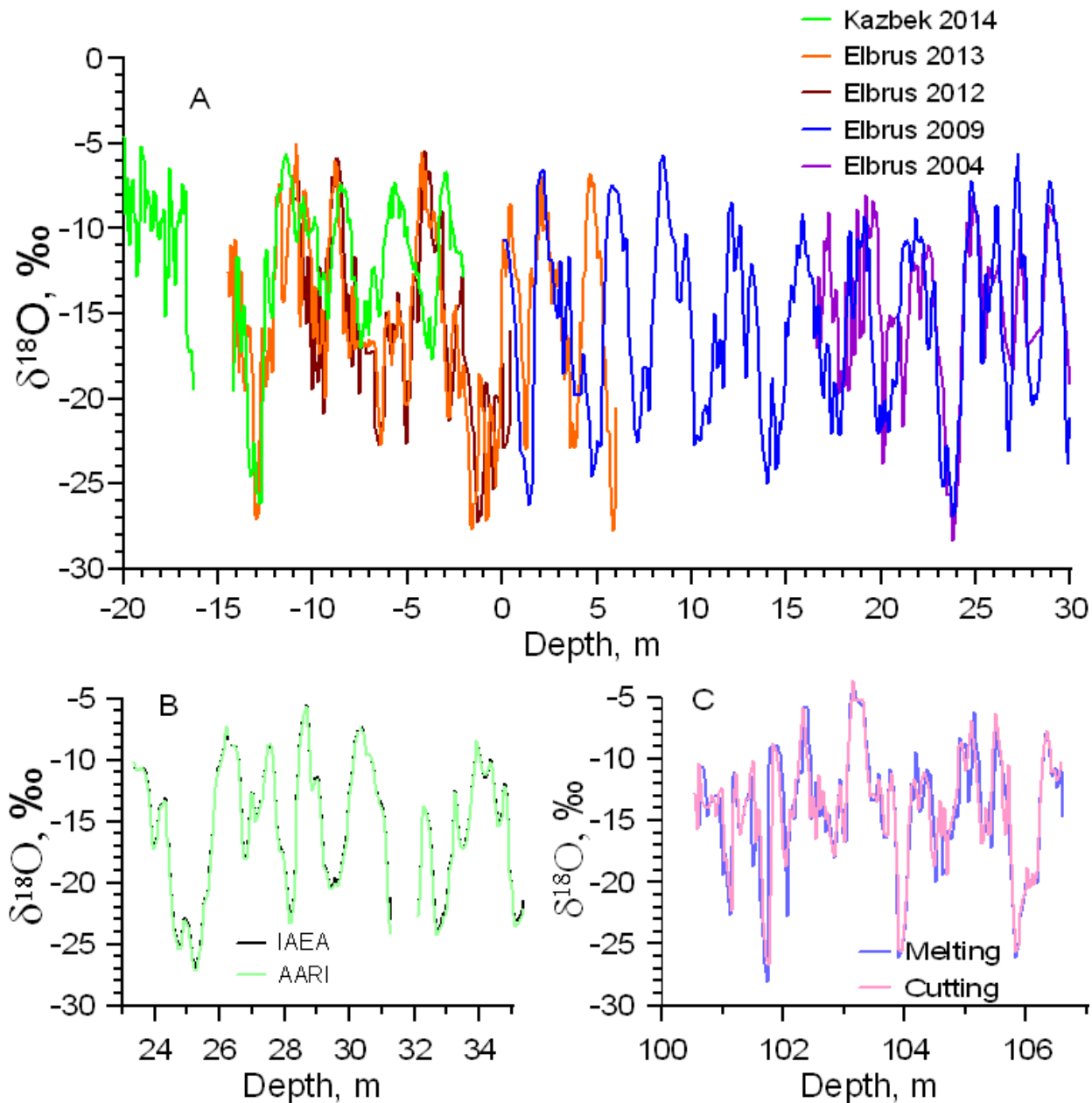
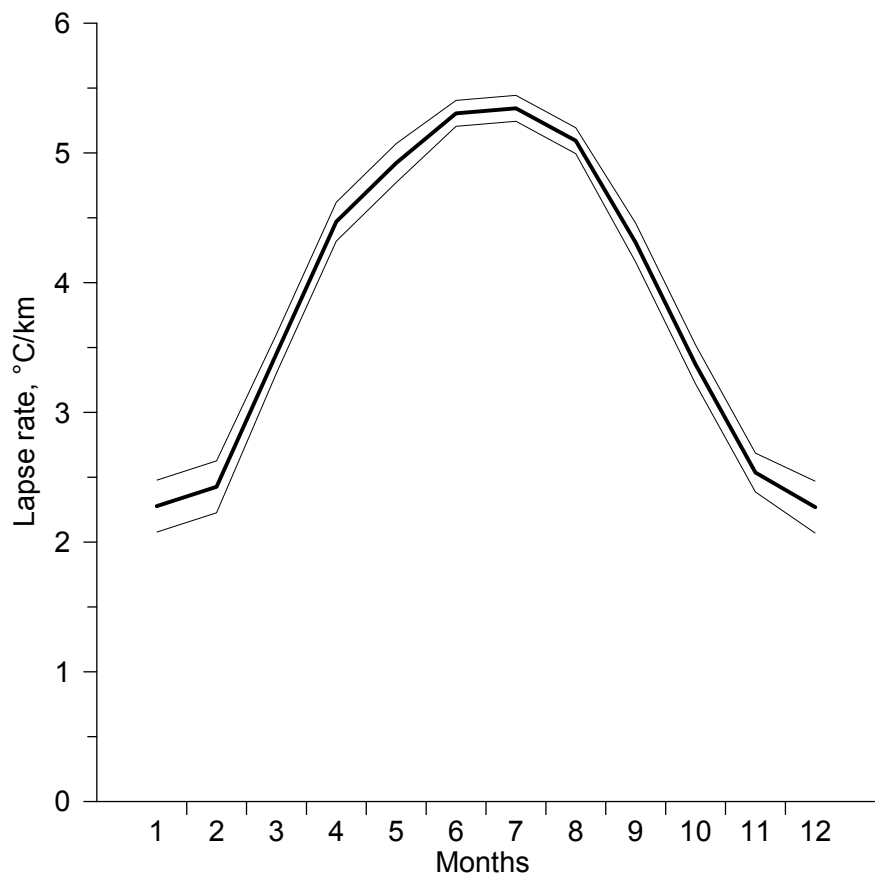


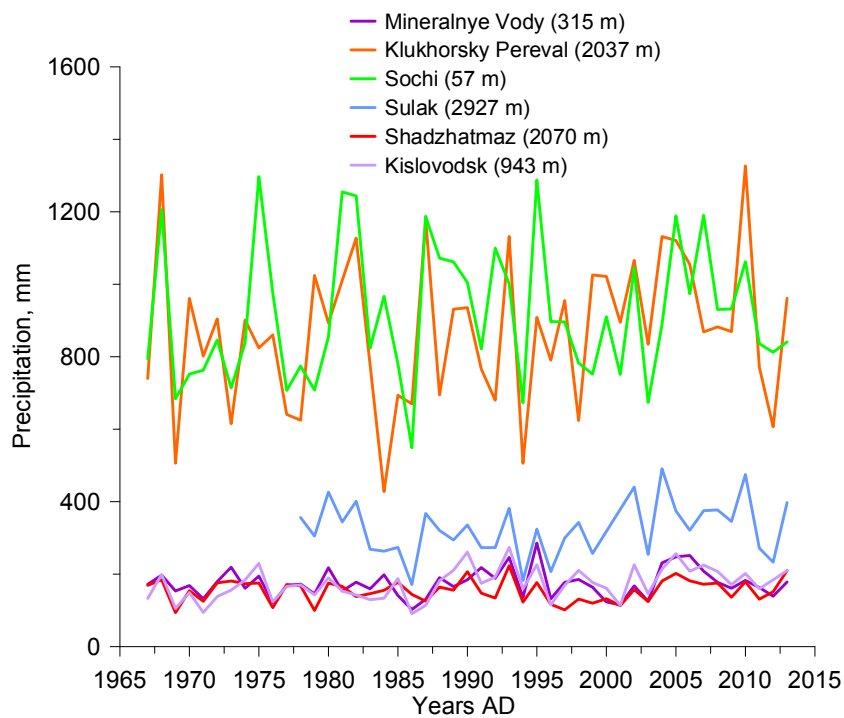
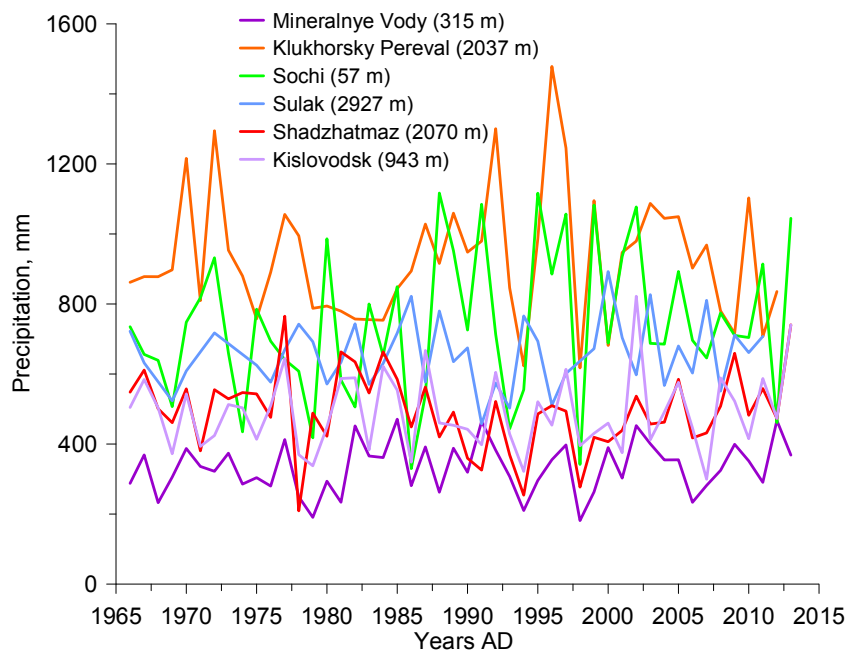
Fig. S1: Example of the back-trajectories calculations in FLEXPART model: A – July 2012; B – January 2011



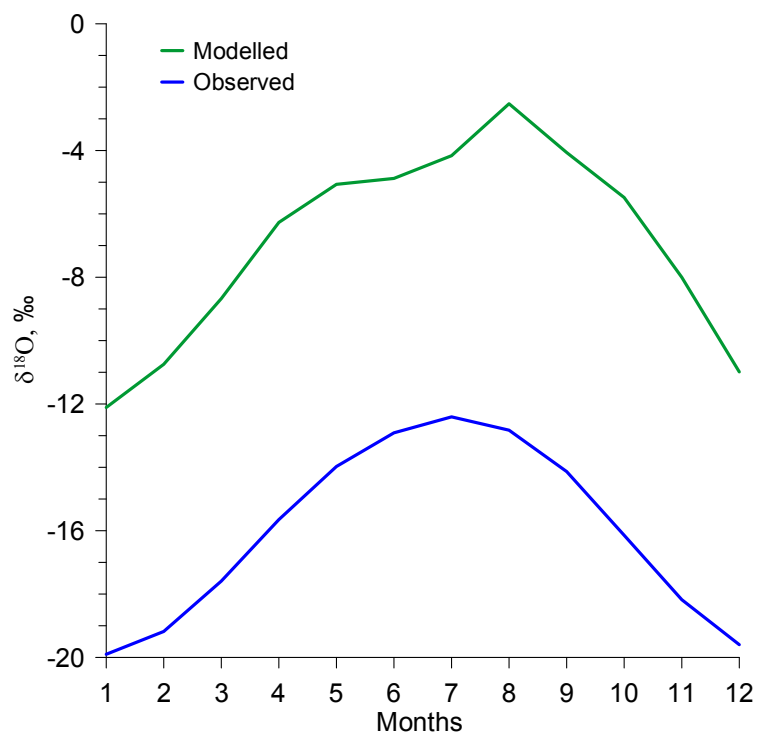
**Fig. S2: Ice core  $\delta^{18}\text{O}$  records.** a) Comparison of the various depth profiles of  $\delta^{18}\text{O}$  obtained at Elbrus from cores drilled in 2004 (purple), 2009 (blue), 2012 (brown), 2013 (orange) and from Kazbek (green). Individual records have been shifted by the depth range corresponding to the start of each record. All measurements were performed at AARI. b) Comparison between  $\delta^{18}\text{O}$  data measured at AARI (green) and IAEA (black), for a 12 meter ice section, demonstrating the quality of the analytical procedure at AARI. c) Comparison of  $\delta^{18}\text{O}$  data obtained through two different sampling approaches for a 6 m ice segment: in pink, based on the classical cutting approach; in blue, for discrete samples obtained through the continuous flow analysis device (therefore through a continuous melt approach). Note that the exact depth step for each sampling was different. See the main text for details.



**Fig. S3:** Calculated monthly mean lapse rate, based on available regional meteorological data for the 1966-1990 period. Thin lines show the uncertainty of the lapse rate estimation.



**Fig. S4: Precipitation rate in warm season (upper panel) and in cold season (lower panel). Numbers in brackets indicate the altitude of the station above the sea level.**



**Fig. S5.** Comparison of the precipitation isotopic composition seasonal cycle at the Elbrus Western Plateau: derived from the ice core data (blue line) and calculated in LMDZiso (Risi et al., 2010) model (green line).