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December 2015: Unprecedented climatic conditions in the Eastern Alps

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Recent decades have been characterized by a number extreme climate events as heat waves and long-lasting warm periods of exceptional magnitude, such as the summer of 2003 in Europe, the 2010 heat wave in Russia, or the summer of 2015 in Australia. Since global warming is expected to lead to an increase in frequency and magnitude of heat waves, it has been hypothesized that the warming trend during the last century might have influenced the intensity of these events. Here we document the occurrence in December 2015 of unprecedented high temperatures in the observational record of mountain sites in the Eastern Alps dating back up to 150 years. For the first time in this period mean December temperatures exceeded 0oC at elevations up to 2500 m, with December mean anomalies exceeding 7oC with respect to the long term mean (1971-2000) at stations above 2000 m. Such temperatures would lead to winter ablation of glaciers at those elevations of unprecedented magnitude. However much smaller temperature anomalies are found in the surrounding valley and low elevation sites, highlighting the key role of topography in amplifying the anomaly. We also analyse mean sea level pressure, wind and precipitation fields in order to reveal the processes underlying this exceptional event, discussing its occurrence during the 21st century within the context of the highest resolution regional climate change projections available for the area.