Geophysical Research Abstracts
Vol. 20, EGU2018-8485, 2018
EGU General Assembly 2018

Long-term 18O-Records in Precipitation and Global Warming

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In regions with continuous measurements in precipitation and surface water prediction of the isotope composition of the water and the air-temperature in the past and in the future, are possible, and they allow to estimate climate variabilities and the potential impact on water resources and mitigation activities.
Precipitation water of meteorological stations (11) and river water of monitoring stations (6) with long-term (1973-2014) monthly δ18O-measurements all over Austria show a mean increase of 0.8 and 1.0 ‰ (SMOW), respectively. The mean increase of air-temperature in these meteorological stations is 1.7 °C during these 41 years. The ratio of δ18O-increase in precipitation water (‰ SMOW) to air-temperature increase (°C) is in the range of 0.5 and 0.6. This ratio is similar to the ratio obtained in each single meteorological station based on monthly data, irrespective of its position on a mountain or in a valley, indicating that temperature is the dominant fractionation factor of δ18O in precipitation and river water and its decadal increase of 0.2 to 0.25 ‰ is caused by global warming during this period. In addition, simultaneous enhanced increase of δ18O and air-temperature during 1980-1990 and 2001-2006 in many stations supports this conclusion. This continuous change in δ18O in precipitation and rivers show that long-term monitoring data are important and current data must be used to trace a water cycle.