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# Geodetic climate research in the Austrian Alps

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The Federal Office of Metrology and Surveying (BEV) in Austria is responsible for the geodetic reference system like gravity and height reference frame. Some of these gravity reference stations are monitored regularly by different geodetic terrestrial techniques. The gravity data on some stations show variations and/or changes in gravity. In this presentation, the alpine geodetic reference stations Obergurgl and Franz-Josefs- Höhe in the Austrian eastern Alps will be presented. Both stations are investigated with different geodetic terrestrial techniques in a cooperation of the University of Luxemburg with BEV.

Global warming and associated climate change during the last century and recent decades are among the main reasons for glacier retreat in the Alps. Absolute gravity measurements have been regularly performed in the Austrian Eastern Alps since 1987 in the Ötztal Valley at Obergurgl. In addition, absolute gravity has been regularly observed at Obergurgl from 1987 to 2009 with the absolute gravimeter JILAg6. From 2010, the absolute gravity measurements were continued with the highest accurate absolute gravimeters FG5 from BEV and FG5x from University of Luxemburg. The newest gravity data show again a small increase of gravity. Additionally, a permanent GNSS station was established in 2019 to record information about the assumed vertical uplift at this station.

A second alpine research station was established near the Pasterze Glacier at Großglockner Mountain in 2019. The Pasterze Glacier is one of the largest glaciers in the eastern Alps and is in the vicinity of the highest mountain of Austria, the Großglockner. The station is monitored by repeated absolute gravity measurements and is equipped with a permanent GNSS station. In addition, precise leveling measurements were also tied to this station. In this contribution, initial results of the geodetic research like the gravity results, precise leveling and GNSS measurements will be presented. In the future, gravity data will be quantitively compared to ice mass balance information derived from glacier inventories. A Geodetic Global Navigation Satellite System reflectometry (GNSS-R) antenna will also be installed to study glacier-ice change. A third station at an altitude of 3300 m is planned and will be checked for operating absolute gravity measurements there. The geodynamical processes like vertical uplift and postglacial deformation will be investigated together with glacier retreat on these stations.

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