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High-resolution GPS-tomography in view of hydrological hazard assessment in the canton of Valais (Switzerland)

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The project presented forms part of the ETH research framework HazNETH, which contributes to integral risk management as a basis for sustainable development. It aims at the determination of tropospheric water vapor, which plays an important role in the thermodynamics of atmospheric circulation systems and in the hydrological cycle at local and regional scales. GPS-tomography is a technique to determine the 3-dimensional distribution and temporal variation of water vapor in the atmosphere. The GPS-tomography software package AWATOS, developed at the Geodesy and Geodynamics Lab ETH Zurich, has been successfully used and validated in regional-scale applications (ground resolution of 10 to 40 km) in Hawaii, France and Switzerland.

In order to meet the requirements of hydrological hazard assessment in a local area, the software package has to be further developed in view of a better spatial and temporal resolution. Starting from the national permanent GPS network of Switzerland (AGNES), we focus on a particular area in the Swiss Alps, namely in the canton of Valais. Due to its orientation, the main valley acts as a wind channel and transports the air upwards from west to east and into lateral valleys, where hydrological hazard is witnessed by extreme flooding events. Performing specific a-priori quality analysis, different station distributions are simulated and examined in view of usability for high-resolution GPS-tomography. Criteria for a well-distributed GPS network will be formulated. In the near future, the most promising network will be investigated in dedicated measurement campaigns.