Calculation of air movement in ice caves by using the CalcFlow method

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We present a method to determine the air flow regime within ice caves by temperature loggers. Technical capabilities of conducting airflow measurements are restricted by the availability of energy at the ice cave study sites throughout the year. Though the knowledge of the airflow regime is a prerequisite for the understanding of the cave climate. By cross-correlating different time series of air temperature measurements inside a cave, we define the travel time of the air between the loggers, which corresponds to the time shift of best correlation, and use this result to derive the airflow speed. Then we estimate the temperature biases and scale factors for the temperature variations observed by the different loggers by a least squares adjustment. As quality control for bias and scale we use the formal errors of the estimation process. For the calculated airflow speed quality criteria are developed by use of a simulation study. Furthermore we will apply the method to temperature measurements in the static ice cave Schellenberger Eishöhle (Germany). In the end we show how the method can be used as an advanced filter for the separation of different signal contents of the temperature measurements.