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Title:

About Physics and Calibration Procedure of the first real-time Hail Measurement Sensor

Authors:

Claus Riehle, Dominik Schön

Abstract:

The second generation of the first real-time measurement device for hail is available since 2017 and over the last two years 80 HailSens devices had been produced and installed in Switzerland. The transducer, the electronic design, the final assembling and calibration has been done in Saarbrücken. The transducer of the HailSens and the signal processing is the key issue of the new measurement method. When comparing 80 transducer calibration curves one can see that the HailSens is able to measure the kinetic energy of impacts over three decades (5mJ – 50J) very reliable. This success is based on systematic experiments done in 2016 with respect to similarity thinking, which is common in Process Engineering. The proof of the method had been done by varying the media and the impact parameters of particles. These results clearly showed a strong correlation between transducer signal and the kinetic energy of impacting particles. The uncertainty of measurements with respect to location of impact on the transducer and with respect to repeatability will be discussed. In order to apply the proven impact phenomenon to the characterization of hail events a second correlation is needed. Therefore, series of hail gun experiments had been made with ice particles. Based on these results a dedicated calibration procedure had been developed which includes two essential steps: a general empirical matter constant for hail particles and the calibration process of each individual transducer. The results of more than 100 investigated transducer plates confirm the validity of the physical model behind, the way of signal processing, the procedure of the methodical design of the sensor and the validity of the calibration procedure as the design of the calibration device as well.