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REPORT ON THE USE OF PRECIPITATION DETECTORS FOR THE VALIDATION OF PRECIPITATION EVENTS

(Submitted by Eckhard Lanzinger)

Summary and purpose of document

This document provides information on tests performed on some precipitation detectors and their reliability in detections precipitation events, in particular solid precipitation events.

ACTION PROPOSED

The Meeting is invited to take this information into consideration, when reviewing the required set-up of SPICE testsites and in particular the configuration of the site reference.

Report on the use of precipitation detectors for the validation of precipitation events

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Precipitation detectors are playing an important role in the derivation of the snowfall reference data set. A sensitive, fast reacting and safely detecting device is needed to determine the true duration of snowfall events where accumulation in precipitation gauges can occur. In this short study some experimental results are shown where several precipitation detectors have been validated in a one year comparison by Deutscher Wetterdienst (DWD). Because commercially available instruments are applying capacitive, conductive and optical measuring principles, two detectors of each kind have been purchased. In March 2013 a Vaisala detector was added to the test, because it is widely used on many SPICE sites.

Measuring principle	**Detector / Manufacturer**
Optical	Thies
Optical	IRSS
Conductive	Kroneis
Conductive	Eigenbrodt
Capacitive	Campbell
Capacitive	MPS
Capacitive	Vaisala

The comparison was taking place at two sites in parallel: Wasserkuppe, a mountain site at 950 m asl and Hamburg, a lowland site at 30 m asl. For this short study, one year of data were aggregated in contingency tables and analysed by calculating skill scores. A very sensitive and lag-free optical disdrometer (Thies Laser Precipitation Monitor) was used as the reference for precipitation duration and classification of precipitation type. This also allowed applying a data classification by liquid and solid precipitation.

The results for both sites are shown in Table 1 and Table 2.

In summary one optical detector gave the best performance followed by both conductive sensors. The capacitive sensors gave the lowest skill scores. For snowfall the probability of detection (=hits per number of true events) of the best optical detector was almost twice as much as for the best capacitive detector while its false alarm rate was 4 times lower.

According to the results of this study optical detectors are recommended for use as part of the SPICE reference.

Table 1: Results for Wasserkuppe 05/2012 – 05/2013.

RA+DZ	Thies	IRSS	Eigenbrodt	Kroneis	Campbell	MPS
POD	0.90	0.83	0.84	0.84	0.42	0.49
FAR	0.15	0.29	0.21	0.15	0.04	0.01
FBI	1.05	1.17	1.07	0.99	0.44	0.49
HSS	0.85	0.72	0.78	0.82	0.55	0.62
SNOW	Thies	IRSS	Eigenbrodt	Kroneis	Campbell	MPS
POD	0.75	0.76	0.61	0.73	0.12	0.08
FAR	0.17	0.30	0.26	0.16	0.12	0.04
FBI	0.91	1.09	0.84	0.87	0.14	0.08
HSS	0.76	0.68	0.62	0.75	0.18	0.13

Table 2: Results from Hamburg 05/2012 – 05/2013. The Vaisala detector was added in 03/2013.

RA+DZ	Thies	IRSS	Eigenbrodt	Kroneis	Campbell	MPS	Vaisala
POD	0.83	0.19	0.84	0.86	0.47	0.44	0.83
FAR	0.08	0.09	0.11	0.12	0.06	0.01	0.20
FBI	0.90	0.21	0.94	0.99	0.51	0.44	1.04
HSS	0.86	0.29	0.84	0.85	0.59	0.58	0.79
SNOW	Thies	IRSS	Eigenbrodt	Kroneis	Campbell	MPS	Vaisala
POD	0.93	0.40	0.74	0.81	0.25	0.14	0.50
FAR	0.18	0.13	0.29	0.31	0.28	0.06	0.40
FBI	1.13	0.46	1.04	1.18	0.35	0.15	0.83
HSS	0.86	0.53	0.71	0.73	0.36	0.24	0.51

The test also showed that there is some potential for improvement. Some of the tested detectors are providing a binary (Y/N) output, e.g. a closing contact, whereas others are providing an analogue output signal or both. In the case of an analogue output it is crucial to select an appropriate threshold for high sensitivity and a low false alarm rate. In this study these thresholds were not optimized but rather set at a reasonable value derived by visual analysis of the data. It should also be

kept in mind that the orientation (azimuth) of the detector can play a role if its design is not omni-directional.