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Build, measure, understand: Pupils contributing to meteorological measurement campaigns.

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Voluntary weather measurements have a long tradition and the opportunities have recently expanded with that the advent of the Internet of Things. Atmospheric measurements are prototypical examples for the maker community and popular means to strengthen interest in STEM subjects. In two projects in Germany (in Brandenburg, within the FESSTVaL (Field Experiment on submesoscale spatio-temporal variability in Lindenberg) measurement campaign initiated by the Hans-Ertel-Center for Weather Research, and in Bavaria, in the KARE-Citizen Science project), we use a weather station to be assembled by pupils as a participatory vehicle to increase interest in and understanding of weather and climate, as well as of weather forecasting, and to generate high resolution data for research.

The devices measure e.g. temperature, humidity, radiation, pressure and precipitation in the students' immediate environment. They can be placed in almost any location, since they operate independent of W-LAN and external power supply. The data is visualized directly via a web app. Students report weather impacts, such as observed damage or their own exposure to weather. Due to the pandemic, only a few dozens pupils were able to participate and building their devices had to be done with digital guidance and video support. Further online materials on understanding weather forecasting and its uncertainty were provided.

Understanding of weather risks was surveyed before and after participation to detect any changes. Students were asked questions about thunderstorm, rain and heat events and climatic changes since 1880. The results show a good understanding of weather risks compared to a population of all ages representative study. In online workshops pupils together with the scientists scetched and discussed the influence of the placement of their stations on their measurements. Interesting meteorological phenomena were discovered in the dataset, e.g. a cold pool that can form during a thunderstorm and trigger new ones. Thus, our network of higher spatial and temporal resolution data collected by the pupils has the potential to study these small-scale phenomena in more detail than with professional networks of about 25 km spacing.