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Participation of pupils in atmospheric measurements -- Potential for increasing climate change risk awareness and data availability for weather and climate research

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Voluntarily measuring atmospheric characteristics by citizens has a long tradition. Possibilities has been increasing in the last years with the rise of smart devices and the internet-of-things (IoT). Atmospheric measurements are also prototypical project examples within the Maker community. Maker projects (i.e. IoT-/technology-oriented projects) are popular means of strengthening interest in STEM subjects among pupils. In the frame of two projects, we use an IoT-based weather station to be assembled by pupils as a participatory vehicle to a) raise interest in and understanding of weather and climate, as well as weather forecasts, and b) obtain additional data to be used in scientific projects.

In the project KARE-CS (funding: German Ministry for Education and Research, BMBF), a lay weather network has been set up together with pupils in the Bavarian Oberland south of Munich in 2020 and 2021. The students' devices measure temperature, pressure, humidity, solar radiation and precipitation in their direct environment, data is visualized on their smartphones (or any device running a browser) and updated every few minutes. Pupils also report weather impacts such as observed damages or their own concernment about weather events. These data are evaluated in workshops involving the students, their teachers, local partners and scientists. Atmospheric as well as impact data is evaluated for further use in scientific studies, such as within the mother project KARE (). KARE-CS focuses on upper secondary school students as participants and aim at a development of competences among teachers as multipliers and pupils, particularly in terms of climate change adaptation, understanding natural hazards and risks and in taking personal precautions.

A similar setup is used for supporting the measurement campaign FESSTVaL (initiated for 2021 by the Hans-Ertel-Centre for Weather Research ()). The pupils' network will consist of 100 instruments within and close to the campaign's main site. Additionally to the communication and education-oriented goals mentioned above, the resulting spatially and temporally high-resolution data is

used for research on thunderstorm development and cold pool characteristics within the Hans-Ertel-Centre.