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Linking citizen scientists with technology to reduce climate data gaps

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Among the greatest constraints to accurately monitoring and understanding climate and climate change in many locations is limited in situ observing capacity and resolution in these places. Climate behaviours along with dependent environmental and societal processes are frequently highly localized, while observing systems in the region may be separated by hundreds of kilometers and may not adequately represent conditions between them. Similarly, generating climate equity in urban regions can be hindered by an inability to resolve urban heat islands at neighborhood scales. In both cases, higher density observations are necessary for accurate condition monitoring, research, and for the calibration and validation of remote sensing products and predictive models. Coincidentally, urban neighborhoods are heavily populated and thousands of individuals visit remote locations each day for recreational purposes. Many of these individuals are concerned about climate change and are keen to contribute to climate solutions. However, there are several challenges to creating a voluntary citizen science climate observing program that addresses these opportunities. The first is that such a program has the potential for limited uptake if participants are required to volunteer their time or incur a significant cost to participate. The second is that researchers and decision-makers may be reluctant to use the collected data owing to concern over observer bias. This paper describes the on-going development and implementation by 2DegreesC.org of a technology-driven citizen science approach in which participants are equipped with low-cost automated sensors that systematically sample and communicate scientifically valid climate observations while they focus on other activities (e.g., recreation, gardening, fitness). Observations are acquired by a cloud-based system that quality controls, anonymizes, and makes them openly available. Simultaneously, individuals of all backgrounds who share a love of the outdoors become engaged in the scientific process via data-driven communication, research, and educational interactions. Because costs and training are minimized as barriers to participation, data collection is opportunistic, and the technology can be used almost anywhere, this approach is dynamically scalable with the potential for millions of participants to collect billions of new, accurate observations that integrate with and enhance existing observational network capacity.